ISF2003

The 23rd International Symposium on Forecasting, 2003

FORECASTING IN BUSINESS, FINANCE AND ECONOMICS IN THE ELECTRONIC ERA

Mérida, Yucatán, MÉXICO

June 15th – 18th, 2003



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Welcome Messages



Message from the President of IIF

Welcome, on behalf of the International Institute of Forecasters to its 23rd International Symposium. This is the first symposium to be held in Latin America and the Organising Committee and the Directors of the Institute have aimed to involve as many participants as possible from the region. In particular we have supported a number of doctoral students to attend and present their research. Our aim is to ensure a continuing supply of well-trained forecasting researchers who have a broad perspective of the discipline's important problems.

When we first set up the Institute with the task of organising various meetings and publishing an academic journal few of us thought we would still be involved in arguing the case for serious, practical research into forecasting more than twenty years later. In fact, we rather hoped that our aspirations would have been fully integrated into other perhaps better-established disciplines. That's not proved the case – there still exists the fragmentation we identified when the Institute's objectives were set to unify the disparate strands of forecasting research and practice. While there have been many successes in forecasting research as Scott Armstrong's work on Forecasting Principles has laid out, there is still much to be done. I hope and expect that researchers at this Symposium will take some substantial steps forward. As part of this educational agenda the Directors of the Institute have agreed with SAS to sponsor forecasting research that helps develop the 'Principles of Forecasting' further with the aim of improving forecasting practice. (Details of this can be found on the Institute's web site as well as the Principles site.)

The Institute depends on volunteers. New directors are elected annually to serve a three-year term whilst the president is elected from amongst the directors. The Institute in recent years has been both academically and financially very successful so those who join have a hard act to follow. After more than ten years working for the Institute I will be slowly dropping out of its management. I'm very happy to say that Lars-Erik Öller will be taking up the presidency next year. We're therefore looking for volunteers, volunteers to run the IIF, volunteers to help with activities such as the Oracle and our various conferences. Please contact me or one of the other directors if you wish to be actively involved, or attend the members meeting (you're all members!) which is to be held on Tuesday, 17:30 to 18:00 hours, Salon Merida.

Finally I would like to thank all the organisers of this meeting for the magnificent work they have put in to make our experience here in Merida stimulating and enjoyable. Over these twenty years we ISF old hands have grown to appreciate how the collegiality, the openness and the sheer hard work of the meeting organisers contribute to the vigour of our chosen subject area of forecasting.

> Robert Fildes President, International Institute of Forecasters April 2003



INSTITUTO TECNOLOGICO AUTONOMO DE MEXICO

Fundado en 1946.

Message from the Rector of the Instituto Tecnológico Autónomo de México (ITAM)

Professor Arturo Fernández Pérez

Dear Delegate,

The Instituto Tecnológico Autónomo de México (ITAM) is a higher education institution dedicated to the creation and diffusion of knowledge, with an excellent international reputation. Since its creation in 1946 ITAM has considered the area of forecasting as one of the main areas of knowledge required by our students in their professional lives. Then, it is an honor for ITAM to be involved in the organization of the 23rd International Symposium on Forecasting (ISF2003) and to welcome you to this beatiful and marvelous city of Mérida, Yucatán. I am sure that you will find your participation in ISF2003 a productive time in terms of collaboration with other members of your profession, to be updated on new forecasting techniques used around the world and on new topics of research. Besides I advise you to visit the wonderful mayan and colonial sites in Yucatán.

Thank you for being here.

Best wishes.

Arturo Fernández Pérez

Río Hondo 1, San Angel, C.P.01000 México, D.F. Tel: 628 40 00



Message from the ISF2003 Chair

On behalf of ISF2003 and IIF, I welcome you to the 23rd International Symposium on Forecasting. And on behalf of ITAM, I welcome you to Mexico and Merida, in Yucatan, the land of the Mayas.

It is only fit that meeting in Mexico we do so in the land of the people who discovered zero, who had a sophisticated number system and who were capable of predicting many astronomical events.

They were known to predict eclipses, solar and lunar cycles and solstices and equinoxes. Also, as pointed out by D. de Landa in his Book, *History of the Things from Yucatan*, their scribes, the 'Chilanes', "were charged with giving all those in the community the oracles, ...casting lots in divination...They awarded them utmost respect". It is well known that they made their knowledge to produce impressive shadow displays in Chichen-Itza, which can still be admired to this day. They were their religious 'forecasters', but their divinations also had very practical implications for their every day life.

We have come a long way since, so much that our meeting has as a theme 'Forecasting in Business, Finance and Economics in the Electronic Era'. However, we have also tried to combine theory with relevant applications. We hope the spirit of the Mayan people helps us to achieve our goal.

In addition, the Mayas have left many fabulous works of architecture that were partly result of their mathematical abilities. I invite you to enjoy these wonders and complement your academic and professional activities with visits to some of the many sites available near Merida. I am sure you will return to your countries with a deep feeling of admiration, for some of those early 'forecasters'.

I wish you all a productive and enjoyable stay in Merida.

Enrique de Alba, Chair ISF2003

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ISF2003 Acknowledgements

The ISF2003 Organizing and Program Committees would like to thank the following people at ITAM for their help and support:

Dalia Lizardi (Promotion and Design)

María Rojano (Stat Department Secretary)

Francisco Alonso (Math student) Mariano Bèguerisse (Math student)

ISF2003 Sponsors

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Centro de Investigación en Matemáticas (CIMAT)

Grupo Modelo S.A. de C.V. México

Instituto de Investigaciones en Matemáticas Aplicadas y Sistemas (IIMAS)

Instituto Nacional de Estadística, Geografía e Informática (INEGI)











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Forecast Pro

Millward Brown







Universidad Autónoma de Yucatán

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Program Committee

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Viridiana Lourdes (ITAM) - Poster Session Coordinator

Silvia Ruíz-Velasco (AME)

Esperanza Sainz (ITAM) - Social Program Coordinator



General Information

ISF2003 website:

www.isf2003.org

Mérida

Founded in 1542 by the conquistador Francisco de Montejo on the Mayan Clty of T-hó, Mérida is one of the most interesting cities of México.

Its remote Mayan roots, colonial monuments and the splendor of its XIX century architecture has made Mérida and its surroundings a captivating mixture of cultural influences.

Official ISF2003 Hotels

Conference Venue: Hotel Fiesta Americana, Mérida. Calle 56-A-451, Esq. Av. Colón, C.P. 97000, Mérida, Yucatán, México. Tel. (999) 942 1111 Fax. (999) 942 1112.

Alternative Hotel: Hotel Villa Mercedes, Mérida. Av. Colón 500, Col. Centro. C.P. 97000 Mérida, Yucatán, México. Tel. (999) 942 9000 Fax. (999) 942 9001.

Conference Venue / Services

The Hotel Fiesta Americana offers the following services: Travel Agencies (8 a.m. to 8 p.m.) Car Rentals (8 a.m. to 8 p.m.), Banks (9 a.m. to 1:30 p.m.), Deposit Boxes, Money Exchange, Shopping Arcade (50 exclusive boutiques from 8 a.m. to 8 p.m.), Doctor on duty 24 hours and Recreational Facilities (Health Club, gym, jacuzzi, massages, sauna, steam bath, swimming pool, tennis court and golf course (15 minutes away))

Registration

Registration will take place at the information desk located at the entrance of the Foyer of the Hotel Fiesta Americana (See Conference Venue Map). Sunday 15th (16 to 20 hrs), Monday 16th, Tuesday 17th and Wednesday 18th (Office Hours).

Badges

Delegates are requested to wear their personal badges at all times while attending symposium events.

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Information Desk Services

The information desk will be located at the entrance of the Foyer of the Hotel Fiesta Americana and will offer the following services: Registration, Tours and General Enquiries.

Coffee Breaks

Coffee Breaks are served at the Foyer of the Hotel Fiesta Americana.

Exhibition

The exhibition (see Exhibitors List ISF2003) will take place at the Foyer of the Hotel Fiesta Americana from Sunday 15th in the afternoon, until Wednesday 18th noon.

Tours

The tours and departure times are as follows:

Sunday 15th (Departs 9:00 hrs.):Tour to the archaeological site of Chichén Itzá Monday 16th (Departs 9:00 hrs.): Ecological Tour to Celestún Estuary. Monday 16th (Departs 19:30 hrs.): Uxmal Light and Sound. Tuesday 17th (Departs 8:00 hrs): Tour to Puuc Route and Caverns of Lol-Tún. Wednesday 18th (Departs 15:00 hrs): City of Mérida.

Ask the staff of the information desk for details. The tours are organized by Convention Center.

Tipping

The average tip for servers is between 10% and 15%, depending on the service. Skycaps at the airport can expect anything from \$0.25 to \$0.50 USD per piece of luggage.

Additional Information

Church Services

There exist many christian (catholic) churches in Mérida. For the nearest one to the hotel and for other religion churches ask the staff of the hotel at the lobby.

Banking Facilities

In the conference venue there are banking facilities (9 a.m. to 1:30 p.m.).





Emergency Information

Hospital

In the conference venue there is a doctor on duty 24 hours. Red Cross Telephone: 983 0211

Police

Police Telephones: 925 2031 and 925 2034

Insurance

Please arrange your own travel and health care insurance. The organizers cannot be held responsible for any accident, theft or damage to property, or for delays or any modification in the program due to unforeseen circumstances.



Social Program

Hours	Sunday 15	Monday 16	Tuesday 17	Wednesday 18
8:00				
9:00			Tour to	
10:00	Tour to the	Ecotour	Puuc Pouto	
11:00	Archaelogical	to the	Puuc Roule	
11.00	site of	Celestún	& the	
12:00	Chichén Itzá	estuary		
13:00			Loltún Caves	
14:00				
15:00	(with lunch)	(with lunch)		Mérida
16:00	(,		(with lunch)	City Tour
17:00				-
<u>17:30</u> 18:00				
18:30				
19:00	Reception			
20:00	Reception	Uxmal		
20:30				
21:00		Light &		
21:30		Coursed	Mexican	
22:00		Sound		
22:30			Party & Dinner	
23:00				
20.00		-		

Social Events and Tours

Notes: (1) Light & Sound in Uxmal runs from 21:00 to 21:45 hs (2) Another tour to Chichén-Itzá is planned for thursday 19, with possible extension to Cancún



Exhibitors List ISF2003

Sidney ISF2004

Contact: Dr. Michael Lawrence (general Chair) General enquiries: Elizabeth Greig Faculty of Commerce and Economics, University of New South Wales, Kensington 2052. Tel: +61 (2)93584417, Fax: +61 (2)96624061, Email: isf2004@unsw.edu.au

Elsevier Science

Contact: Paul Jang P.O. Box 211, Amsterdam 1000 AE, The Netherlands. Tel: 31-20 485 3911, Fax: 31-20 485 3809, E-mail: p.jang@elsevier.nl



Elsevier Science is the leading publisher of academic research publishing under the imprints of Pergamon, Academic Press, JAI Press and North-Holland. The *International Journal of Forecasting*, published by Elsevier Science, is the official Journal of the International Institute of Forecasters (IIF) organizers of the 23rd International Symposium of Forecasting. The *International Journal of Forecasting* is made available to members of the IIF as part of their membership. Other established Elsevier journals include *Technological Forecasting and Social Change, Journal of Econometrics, Mathematical Social Sciences* and *Futures*. Book titles published by Elsevier include *Advances in Business and Management Forecasting, Handbooks in Econometrics* and *Handbooks in Economics*.



INEGI

Contact: Pilar García Velásquez Av. Héroe de Nacozari Sur 2301, Fracc. Jardines del Parque, 20270 Aguascalientes, Ags. México. Tel: +52 (449) 918 1550, Fax: +52 (449) 918 1487, E-mail: pgarcia@ca.inegi.gob.mx



The National Institute of Statistics, Geography and Informatics (INEGI) is the agency responsible for integrating Mexico's systems of statistical and geographical information, in addition to promoting and orienting the development of informatics in the country.

Timberlake Consultants

Contact: Ana Timberlake Unit B3, Broomsleigh Business Park, Worsley Bridge Road, London SE26 5BN, UK. Tel: +44 (0)20 86973377, Fax: +44 (0)20 86973388, E-mail: info@timberlake.co.uk



Timberlake Consultants Limited, with origins stretching back to 1982, aims to provide a total solution to clients working in statistics, econometrics, mathematics and operational research. Our areas of expertise fall into three main categories: software sale, training courses and consulting projects.

Business Forecast Systems, Inc.

Contact: Eric Stellwagen 68 Leonard Street, Belmont, MA 02478 USA. Tel: 617 484 5050 x54, Fax: 617 484 9219, E-mail: estellwagen@forecastpro.com Business Forecast Systems, Inc.



Business Forecast Systems, Inc. (BFS) specializes in developing easy to use forecasting software for business. BFS will be demonstrating the Award winning Forecast Pro product line at the symposium. Forecast Pro is a complete forecasting solution for professionals in marketing, sales, finance and manufacturing-it is also a terrific teaching a research tool. Interested attendees can receive a free demonstration package by stopping by the booth. In addition to forecasting software, BSF offers seminars and consulting in the area of statistical forecasting.

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John Wiley and Sons.

Contact: Clare Richardson John Wiley & Sons Ltd., The Atrium Southern Gate, Chichester, West Sussex, PO19 8SQ, UK. Tel: +44 1243 770582, Fax: +44 1243 770154, Email: CRichard@wiley.co.uk



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Special Meetings

Directors Meeting

Saturday June 14th , 2003 14:00 – 18:00 hrs. Sala de Consejo Hotel Fiesta Americana

IIF Directors Dinner

Saturday June 14th , 2003 20:00 hrs. Place to be announced

Directors Meeting

Sunday June 15th , 2003 12:00 - 15:00 hrs. Sala de Consejo Hotel Fiesta Americana

IJF Associate Editors Meeting Sunday June 15th , 2003 15:00 – 16:00 hrs.

Salón Mérida I Hotel Fiesta Americana

IJF Associate Editors Dinner

Sunday June 15th , 2003 20:30 hrs. Place to be announced

IIF Members Meeting

Tuesday June 17th , 2003 17:30 - 18:00 hrs. Salón Celestún Hotel Fiesta Americana

Future Organizers Meeting Tuesday June 17th , 2003 18:00 – 18:30 hrs.

Salón Celestún Hotel Fiesta Americana

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ISF2003: Official Hotels Map

CONFERENCE VENUE:

Hotel Fiesta Americana, Mérida Address: Calle 56-A-451, Esq. Av. Colón C.P. 97000, Mérida, Yucatán, México. Tel. (999) 942 1111 Fax. (999) 942 1112

ALTERNATIVE HOTEL:

Hotel Villa Mercedes, Mérida

Address:

Av. Colón 500, Col. Centro. C.P. 97000 Mérida, Yucatán, México. Tel. (999) 942 9000 Fax. (999) 942 9001



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Conference Venue Map

Conference Venue: Hotel Fiesta Americana, Mérida



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Keynote Addresses

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Keynote Addresses



Monday, 8:30 – 9:30 --- Room: Salón Yucatán I and II Chair: Graciela González

Stable Seasonal Pattern Models: History, Recent Developments, and Applications in Forecasting

with Rong Chen and Airong Cai of the Department of Information and Decision Sciences, University of Illinois at Chicago

Thomas B. Fomby

Professor Department of Economics Southern Methodist University Dallas, TX 75275

This paper reviews the early history and applications of the so-called **Stable Seasonal Pattern Model**. Recent developments in the literature of the model are reviewed and a new approach to the specification, testing, and estimation of Stable Seasonal Pattern models is proposed. This approach draws on the literature of compositional data analysis (e.g. J. Aitchison, <u>The Statistical Analysis of Compositional Data</u>, Chapman and Hall, 1986). In this approach the total of each year is divided into seasonal "shares" and these shares are modeled as multivariate log-normal ratios. The compositional analysis approach allows straightforward testing of stablility in the seasonality of time series data. Forecasting using this approach is also straightforward. The forecasting ability of the "compositional form" of the Stable Seasonal Pattern model is compared with that of seasonal Box-Jenkins models using several seasonal time series data sets.

Professor Fomby has at SMU since 1975. He is co-Econometric Methods and has professional journals including Statistical Association, Journal of Statistics, Technometrics, Econometrics, and the Journal of Professor Fomby is currently co-**Econometrics** (Elsevier specializing in recent techniques as applied to forecasting. marketing. and specialization is in time series economic and business recent research interests include threshold cointegration, outlier



been a Professor of Economics author of the textbook Advanced authored numerous articles in the Journal of the American <u>an</u>d Business Economic Econometrica, Journal of Applied Econometrics. editor of Advances in Science), a research annual developments in econometric problems in economics, finance, Professor Fomby's area of analysis with emphasis on forecasting applications. His stable seasonal pattern models, and intervention analysis, and

change point problems. Professor Fomby has served as a Research Associate to the Federal Reserve Bank of Dallas and has consulted with the U.S. Treasury Department, the Federal Reserve Bank of St. Louis, and various corporations including Blockbuster Video, Texas Instruments, KPMG, and Fireman's Fund Insurance Company.



Tuesday, 8:30 – 9:30 --- Room: Salón Yucatán I and II Chair: Alfredo Bustos

An Application of Forecasting to Quality Control of Data

Agustín Maravall

Banco de España.

Parallel to the increase in the number and size of data bases, there has been a growing concern with their quality, and with the need to detect errors in incoming data. When the number of series runs into (perhaps many) hundreds of thousand, quality control of newly reported data is typically made at a relatively high level of aggregation, using same ad-hoc measures as guidelines.

In this paper, a method is presented that can be efficiently used at a highly disaggregated level. The method provides an answer to the following question: Consider a set of time series that are periodically updated. When the data for a new period becomes available, which of the new observations are likely to be erroneous? The answer is based on the following criterion: A new observation is suspicious when it is very far from what could have been reasonably expected given the past values of the variable.

In brief, the method does the following. Ignoring the new reported data, regression-ARIMA models are automatically identified for each series. The series may have missing observations, be contaminated by outliers of several types, and affected by calendar effects (such as Trading Day) and other regression variables. Forecasts of the series are obtained and compared to the new data. If the forecast error is unreasonably high, the new value is picked up as suspicious of containing an error. The method, for monthly or lower frequency of observation, is enforced by program TERROR, a particular application of programs TRAMO or TSW, freely available at the Bank of Spain web site (www.bde.es). TRAMO can also be efficiently used, in fact, for other large-scale applications. The paper concludes with an illustrative example.

Agustín Maravall is Department of the Banco de Professor at the European Economist at the US Federal Engineer at the Spanish Ph.D. in Economics from the and a doctorate in Engineering been Associate Editor of Journal of Econometrics, the Statistics, and Econometric about 100 publications mostly analysis and dynamic author of several statistical SEATS, TERROR, TSW),



Chief Economist at the Research España, and has formerly been University Institute in Florence, Reserve Board of Governors, and Ministry of Agriculture. He holds a University of Wisconsin-Madison, from the University of Madrid, has several journals, including the Journal of Business and Economic Reviews, among others, and has in the area of applied time series econometrics. He is author/cocomputer programs (TRAMO, widely used by Central Banks and

Statistical Offices throughout the world, and is an elected member of the International Statistical Institute, a Fellow of the Journal of Econometrics, and a Fellow of the American Statistical Association.



Wednesday, 8:30 – 9:30 --- Room: Salón Yucatán I and II Chair: Eduardo Gutiérrez-Peña

Bayesian Prediction in Finance

José Mario Quintana

The Nikko Securities Co. International, Inc.[†] and Bayesian Enhanced Strategic Trading LLC, USA JoseMarioQuintana@2BestSystems.Com (This talk is based on joint work with Viridiana Lourdes, ITAM, México, and Omar Aguilar, Lehman, NY) [†] The Author's views are personal and not necessarily shared by The Nikko Securities Co. International, Inc., its parent or any of its affiliates.

There is a long-standing controversy regarding whether or not the financial markets are efficient and therefore unpredictable. The stream of information news is processed almost instantly, the question is whether there are over-reactions and under-reactions, or flawless assimilation. In this talk, we discuss the predictive ability, and money-making means, of dynamic Bayesian models developed and implemented in the last decade and half to forecast global financial markets.

José M. Quintana, Bayesian Enhanced Strategic November 2001 as a licensing Concurrently, Mr. Quintana is of the Global Dynamic Asset Securities Co. The Nikko joined NSI in March 2002 Management Investment Managing Director and co-Head Allocation Group. Prior to this, Quantitative Research for the Global Investment the Trust Company; Vice President Sector of Chase Manhattan Investors Management Hedging Group; Staff Forecasting Analysis and



Ph.D., Chairman of BEST-Trading LLC, which he founded in company for investment models. Executive Vice President, Head Allocation (GDAA) Group with International, Inc. (NSI). He together with his team from CDC Corporation where he was a of the Global Dynamic Asset he was Vice President of Strategic Asset Allocation team in Management Group of Bankers in the Global risk Management Bank; Vice President at Chase Corporation's Indexing and Supervisor for AT&T's market Directorate. Mr. Quintana's

research interests are Bayesian Forecasting and Optimal Decision Making in the Investment Management context. He has published articles, in both the academic and popular press, on a variety of topics, from dynamic statistical modeling, to optimization algorithms, to portfolio management techniques.

Mr. Quintana has made presentations regarding Bayesian Analysis and Investment Management at numerous international conferences, Mr. Quintana received his Ph.D. in 1987 in Statistics from Warwick University in England, his M.S. in Statistics & O.R. in 1981 and his B.A. in Actuary in 1976 from Autonomous University of Mexico.

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Practitioner Lunch Address

Practitioner Lunch Address

Practitioner Lunch Address

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Monday, 12:25 - 13:45 --- Room: Salón Yucatán I and II

Organizer and Chair: Leonardo Tashman

The Challenges of Economic Forecasting in a Post 9/11 World

Nariman Behravesh

Chief Economist Global Insight 24 Hartwell Avenue Lexington, Massachusetts 02421 (781) 860-6483 nariman.behravesh@globalinsight.com

War, acts of terrorism and other geopolitical events increase the band of uncertainty around any forecast. In such events, the truism that "a forecast is only as good as the assumptions it is based on" becomes even more apt. Even more important, during times of great uncertainty, understanding the sensitivity of forecasts to changes in the key assumptions becomes critical. In these circumstances, scenario analysis is a useful tool in trying to quantify the dimensions of uncertainty.

This presentation will discuss the challenges that the terrorist attacks of September 11, 2001 posed to forecasters, and how the lessons learned in the wake of that episode can be applied to the daunting geopolitical risks facing the global economy today.

Nariman Behravesh is Chief President for Global Insight capacity, he manages Global Macroeconomics Group and is economic outlook and risk Japan and emerging markets.

As Global Insight's chief macroeconomic outlook as well Dr. Behravesh is called upon to business groups, including director. He manages a group North America and Europe, who political developments in over has developed Global Insight's



Economist and Executive Vice (formerly DRI-WEFA). In this Insight's Global responsible for developing the analysis for the U.S., Europe,

spokesperson on the as global opportunities and risks, do frequent presentations for senior executives and boards of of 40 professionals, located in cover economic, financial and 160 countries. In 1995 his team unique *Global Risk Service*,

which provides a disaggregated analysis of country risk for global investors. More recently, his team has helped to develop *Global Outlook* and *MyInsight*, the web-based delivery platform for Global Insight's insights on worldwide economic, financial and political developments.



Dr. Behravesh was the host of the PBS television series <u>Inside the Global Economy</u>. He has authored numerous articles in such publications as *European Affairs* and *Credit Week*, co-authored two books, *Economics U\$A* and *Microcomputers*, *Corporate Planning and Decision Support Systems* and was a contributing author to a recent book on scenario analysis, entitled *Learning From the Future*.

Dr. Behravesh has been quoted extensively in the media on such topics as export opportunities, trading blocs, globalization, country risk and, most recently, the Asian and Latin American crises. He has been cited frequently in publications such as *The Wall Street Journal*, *The New York Times*, *The Financial Times*, *Business Week*, *Newsweek*, *Time Magazine*, *Fortune*, *Forbes* and *U.S. News and World Report*. He has also made appearances on national radio and television programs such as *CNN*, *NBC Nightly News*, *CNBC* and *The News Hour with Jim Lehrer*.

Before joining Global Insight, Dr. Behravesh was Chief International Economist and Research Director for Standard & Poor's DRI. Prior to that he was President and CEO of Oxford Economics U.S.A., Inc. He also spent 10 years at the WEFA Group, where he held a number of positions, including Group Senior Vice President. Early in his career Dr. Behravesh worked at the Congressional Budget Office and the Federal Reserve.

Dr. Behravesh holds Ph.D. and M.A. degrees in Economics from the University of Pennsylvania, and a B.Sc. from the Massachusetts Institute of Technology. He has lived in Europe and the Middle East, and is fluent in several languages. He travels extensively to Europe, Asia and Latin America.



Workshops

Workshops

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Workshops



Workshop 1

Advances of Neural Networks in System Identification and Forecasting: Principles, Techniques, Applications

by Hans Georg Zimmermann Senior Principal Research Scientist Siemens AG, Corporate Technology

The different topics of the program are presented by first discussing the principal underlying problem, solving it with neural network techniques and showing the consequences for applications. The areas of applications cover financial, demand and supply forecasting.

The below program is a full day workshop. Coverage will be adapted to audience.

9:00 am - 10:30 am

- 1. Introduction to Neural Networks (Basics and historical notes)
- 2. Neural Networks in Nonlinear Regression
- (What is the main algorithmic property for high dimensional nonlinear modeling?)
- 3. Learning = Optimization?
- (In the first glance yes, but is a deep minimum always the best solution?)
- 4. The Observer Observation Dilemma (Besides the model building from data can we use the model to evaluate the data?)
- 5. Neural Networks in Approximation Theory (Advances and drawbacks of global versus local basis functions and how to combine them?)
- 6. From Pattern Recognition to the Modeling of Dynamical Systems (How to incorporate dynamic properties in the modeling with feedforward neural networks?)

10:30 am – 10:45 am Coffee break

10:45 am – 12:15 pm

- 7. Model Based Feature Selection
- (Are the good or bad features easier to characterize by a learned model?)
- 8. Remedies for Overfitting
- (What are the advances and drawbacks of Regularization and Pruning Techniques?) 9. Recurrent Neural Networks
- (How the unfolding in time approach transforms temporal problems?)
- 10. Local Algorithms for Non-local Structures
- (Unfolding in time is a non local structure how to keep at least the algorithms local?)
- 11. Analysis of Open Systems

(Economic data are mainly measured from open systems. How to extract the autonomous subsystem?)

12:15 pm – 1:30 pm

The 23rd International Symposium on Forecasting





Lunch

1:30 pm - 3:00 pm

12. Error Correction Neural Networks

(How to modify the neural network architecture to gain a more shock resistant model?) 13. Variance - Invariance Separation

(How can we improve the forecasting of high dimensional systems by the learning of invariances?)

14. Optimal State Space Reconstruction

(How to learn a state space transformation, such that the related forecast problem becomes easier?)

15. Time in Time Series Analysis

(Can the forecast problem be supported by building a model on a finer time grid than the given data?)

3:00 pm – 3:15 pm

Coffee break

3:15 pm – 5:00 pm (open)

- 16. Continuous versus Discrete Density Estimation
- (How to model continuous density estimation and discrete unspecific distributions?)
- 17. Stochastic Modeling of Open Dynamical Systems
- (How to combine drift and diffusion modeling in a stochastic neural network?)
- 18. Causal-Retro-Causal Neural Networks
- (How to model human controlled dynamical systems?)
- 19. Multi-Agent Market Modeling by Neural Networks
- (Neural networks are usually used as an econometrical tool. How to do an economic model building?)
- 20. Miscellaneous Topics

(How to model a decision support system directly instead via a forecasting model?)

Cost: \$80

About Dr. Zimmermann:

- Bonn, diploma 1982 in mathematics.
- Research in applications of control theory in economics at the University of Bonn until 1987, Ph.D. 1987 in economics.
- Since 1987 at the department for Corporate Technology, Siemens AG. Research in circuit simulation, since 1988 in neural networks.
- Work in the development of feedforward, recurrent and neurofuzzy network architectures and algorithms for the modeling of economical dynamical systems.
- Since 1990 leader of the project group ' Neural networks for forecasting and diagnosis.
- Head of the SENN development (Simulation Environment for Neural Networks).

Current research interests: Optimization, time series analysis and economic applications of neural networks.



Workshops

Workshop 2

Concepts in Data Mining

by Marietta Tretter, PhD Texas A&M University

Duration: 8am-12 noon.

8-9am - Introduction to data mining, what it can and can't do.

9-10:00 - Walk through the fitting of a typical data mining model to a large data set --using computer handouts from JMP.

10-10:30 - Coffee Break

10:30-12 noon - Walk through of fitting a data mining model to time series data for forecasting--using computer handouts from JMP.

Cost: \$40

About Dr. Tretter:

Education

Colorado State University-Pueblo	Mathematics	BS (1965)
University of Wisconsin—Madison	Math/Education	MS (1969)
University of Wisconsin—Madison	Quantitative Ed Psych	PhD (1973)

Academic and Professional Experience

9/94-Present Professor, Information and Operations Management, Texas A&M University.
9/81-6/1994 Associate Professor, Business Analysis & Research, Texas A&M University.
9/75 – 5/1981 Assistant Professor, Management Science, Pennsylvania State University.
6/73 – 6/1975 Project Associate, Sociology Department, University of Wisconsin-Madison
7/71 – 5/73 Research Assistant, Sociology Department, University of Wisconsin-Madison.
8/69 – 6/71 Research Assistant, Psychometric Lab, University of Wisconsin-Madison.
1-8/69 Programmer, High Energy Physics, University of Wisconsin-Madison.
9/66 – 12/67 Data Processing and Mathematics Instructor, ATVI, Albuquerque, New Mexico.
6/65 – 8/66 Programmer – Accounting First National Bank, Pueblo, Colorado.



Schedule of Practitioner Track Room: Celestún

Hours	Monday 16th	Tuesday 17th	Wednesday 18th
0.20-	Panol	Panol	Presentation
9.30- 11·10	What Does It Take to	Forecasting for Supply	Pharmaceutical
11.10	Improve Judgemental	Chain and Enterprise	Forecasting: How to
	Forecasts?	Resource Planning	Optimize Sales Calls
		5	and Product Samples
	Michael Lawrence, Marcus	Robert Fildes,	Sandy Balkin &
	O'Connor, Michael Nelson &	Paul Goodwin &	Adam Yaroshinsky
	Diek Ofikal-Alay		
11:25-	Tutorial	Tutorial	Tutorial
12:25	How to Predict	Beyond Exponential	Forecasting and time
	Decisions in Conflict	Smoothing to Model	series analysis using
		Promotions, Business	non-linear models
		Interruptions and other	
	Kaatan Oraan	Aperiodic Events.	Datrial Macharm
	Kesten Green	Enc Stellwagen	Patrick McSharry
12:25-	Lunch Address]	
13:45	Nariman Behravesh		
40.45	•	Description	1
13:45-	Iutorial	Two Examples in Applied	
14.45		Macroeconomic Eorecasting	
	John Boylan &	Patrick Newport &	
	George Karakostas	John Mothersole	
45.00		T (1
15:00-	Presentation	Iutorial Dulo Deced Forecosting	
16.00		Rule based Forecasting.	
	Forecasts – Examples	to Combine Ecrecasts	
	from State Revenue	to combine i brecasts	
	Forecasting		
	Roy Pearson	Monica Adya	
40.00			1
16:00-	Presentation & Panel		
17:00	Userui Knowledge	How a Large Scale	
	About Forecasting	wacroeconomic woder can be	
		Major Economic Events	
	Scott Armstrong	Patrick Newport &	-
	Keith Ord, Eric Stellwagen &	Jeannine Tod	
	Len Tashman		

Schedule of Practitioner Track





Practitioner Track

Practitioner Track

The 23rd International Symposium on Forecasting

PAGE **36**




Practitioner Track: Monday

Monday, 9:50 - 11:10 --- Room: Celestún

Practitioner Track Panel Discussion

What Does It Take to Improve Judgemental Forecasts?

Panelists

Michael Lawrence, Faculty of Commerce and Economics, University of New South Wales, Sydney, AUSTRALIA, M.Lawrence@unsw.edu.au

Marcus O'Connor, School of Business, University of Sydney, Sydney 2006 AUSTRALIA, m.oconnor@econ.usyd.edu.au

Michael Nelson, Faculty of Commerce and Economics, University of New South Wales, Sydney, AUSTRALIA, michael nelson@hotmail.com

Dilek Önkal-Atay, Faculty of Business Administration, Bilkent University, 06800 Ankara, TURKEY, onkal@bilkent.edu.tr

Practitioner surveys confirm the widespread use of management judgement as the primary tool for estimating short term sales forecasts. Although laboratory-based research studies show that management judgement can result in accurate forecasts, field studies of practitioners show the prevalence of biased and inefficient forecasts. A large study in Australia of multi-national manufacturing organisations revealed that a majority of their forecasts were no more accurate than a simple no-change forecast (i.e. next period's forecast is set equal to last period's sales), despite their knowledge of planned promotions and competitor activity. In a number of organisations, forecasts overall were significantly worse than the no-change forecast.

There are a number of simple reasons for this generally poor performance, which this panel session will explore. The panellists, four prominent researchers in the field of judgemental forecasting, will discuss the general issue of improving judgemental forecasts and specifically focus on:

- the link between forecasting and decision making specifically, the influence of one on the other and the relevance of this issue to improving forecasting,
- why updating forecasts to reflect current knowledge so often makes the forecast worse, and what can be done about this.
- the value of communicating uncertainty in the forecasts and when this should be done,
- choice of forecasting format, and effects of feedback.



Monday, 11:25 - 12:25 --- Room: Celestún

Practitioner Track Tutorial

How to Predict Decisions in Conflict

Presenter: Kesten C. Green, Victoria Management School, Victoria University of Wellington, NEW ZEALAND, kesten.green@vuw.ac.nz

Will your company's takeover plans succeed? What would you have to offer workers to avoid a strike? How will competitors respond to your new product? This tutorial will warn against two methods that are commonly used or recommended for forecasting decisions in conflicts but are *not* accurate, and teach two novel methods that are. In particular, do *not* rely on the forecasts of experts who have used their unaided judgement: they are unlikely to be accurate. Neither are the forecasts of game theorists. *Do* use structured analogies (a formal analysis of similar conflicts) and simulated interaction (a type of role playing). When experts can each think of at least two conflicts that are similar to a target conflict, use the outcomes of these analogies to derive accurate forecasts. Use simulated interaction to forecast decisions in any important conflict and to test alternative strategies. Give participants descriptions of their roles and then the situation. Ask them to simulate future interactions with participants playing the roles of other parties. The decisions made by even novice role players are likely to be accurate forecasts of the decisions that will be made in real conflicts. Vary descriptions to test alternative strategies.

Kesten C. Green has been a businessman and manager for most of his adult life. He was a founder of an economic forecasting and consulting business, a horse racing magazine providing win probabilities based on regression models, an earth block making business and, in 1995, his current market and social research business, Decision Research. In recent years Kesten has devoted much of his time to research on how best to forecast decisions in conflicts. This research has been so productive and personally rewarding that Kesten is now contemplating a move to academic life in the US.



Monday, 13:45 - 14:45 --- Room: Celestún

Practitioner Track Tutorial

Forecasting for Lumpy Demand

Presenter: John Boylan, Buckinghamshire Chilterns University College, Buckinghamshire, ENGLAND, John.Boylan@bcuc.ac.uk and

Co-researcher: George Karakostas, Syncron (UK) Ltd & BCUC, George.Karakostas@syncron.com

Lumpy demand presents severe problems for forecasting and inventory management, by virtue of its irregularity and erratic nature. There are two main approaches to forecasting such demand: 'parametric' methods, such as Croston's method and its modifications, and 'bootstrap' methods.

Bootstrap estimates for intermittent and lumpy demand have been discussed in research papers and implemented in commercial software. The main argument in favour of such an approach is that it provides ready estimates of quantiles for the whole distribution of demand over lead-time, without having to rely on possibly unrealistic assumptions about demand patterns. Although such an approach is attractive, it has not been subjected to theoretical critique. Moreover, little empirical evidence has been provided to help practitioners evaluate the forecasting accuracy and inventory implications of a bootstrapping approach in comparison to parametric methods.

In this presentation, we examine arguments for and against the bootstrap. We identify some common problems for the different approaches, and investigate possible modifications to bootstrap methods to improve demand estimates. Likewise, we assess the inventory implications of the two approaches. Our empirical evidence comes from large data sets taken from a variety of industry sectors. We use this data to compare the forecasting accuracy of parametric methods of forecasting intermittent demand (eg Croston, Syntetos and Boylan) with bootstrapping approaches.

John Boylan is Reader in Management Science at Buckinghamshire Chilterns University College. He was educated at Oxford University (MA) and Warwick University (MSc, PhD) and has worked in Operational Research at Rolls-Royce (Aero) and Unipart Group, as well as consulting for Manugistics. His research interests are primarily related to short-term forecasting, particularly in an inventory management context. His publications (Journal of the OR Society, International Journal of Production Economics, International Journal of Foreasting) have increasingly focused on the theoretical and practical aspects of forecasting slow, intermittent and lumpy demand. He is currently working on a two-year research project with George Karakosatas, at Syncron (UK) Ltd, undertaking detailed empirical testing of various approaches to forecasting and inventory management. Some of the results from this project are discussed in today's talk.



Monday, 15:00 - 16:00 --- Room: Celestún

Practitioner Track Presentation

How to Apply Rationality Tests to Evaluate Forecasts - Examples from State Revenue Forecasting

Presenter: Roy L. Pearson, Chancellor Professor of Business, College of William and Mary, USA, roy.pearson@business.wm.edu.

Do state revenue forecasters make biased forecasts, and do they fail to use available historical information effectively in their forecasting? If so, then their forecast errors are unnecessarily large, and these could be reduced by recognizing and correcting for these sources of error. Researchers have used the weak rationality and strong rationality tests to analyze the accuracy, bias, and rationality of state revenue forecasts. When forecasts are compared to the actual outcomes, rejecting the hypothesis of weak rationality or of strong rationality is strong evidence that the forecasters are inefficient. In other words, the forecasters can be called irrational.

The weak and strong rationality tests easily can be added to any forecaster's methods for evaluating the accuracy of their forecasts. Thus the application of these tests to the Virginia revenue forecasts provides an example that any forecasters can use in evaluating the efficiency of their forecasting methods.

Roy L. Pearson is Chancellor Professor of Business at the College of William and Mary. Roy's specialty is forecasting, which he has been teaching in the MBA program since1974. From 1984 to 1998 as Director of the College's Bureau of Business Research, he regularly published his quarterly two-year-ahead forecasts for Virginia and six of its metropolitan areas, and he continues to prepare national, state, and sub-state forecasts at least twice a year. He has served on the Governor's Advisory Board of Economists, responsible for reviewing the state's revenue forecasts and forecasting methodology, under five Virginia governors. He also has been a continuing member since 1984 of the Virginia Employment Commission Trust Fund Advisory Committee, a forecast review panel. Dr. Pearson is on the Board of Directors of the International Institute of Forecasters and serves as editor of the Institute's newsletter, the *Oracle of 1IF*. He served as President of the Virginia Association of Economists in 1990-91 and was named a Distinguished Fellow of the association in 1998. In 1994-95, he was President of the Association for University Business and Economic Research, comprised of over 100 research bureaus, and was named an Honorary Member in 1999. He has been a member of the National Association for Business Economics since 1974.



Monday, 16:00 - 17:00 --- Room: Celestún

Practitioner Track Presentation and Panel Discussion

Useful Knowledge about Forecasting and How to Find It

Presenter: J. Scott Armstrong, Professor of Marketing, The Wharton School, U. of PA, Phila, PA 19104, USA, http://www.jscottarmstrong.com

Over the past half-century, researchers have learned much about how to improve forecasting. They published their findings in academic journals. Unfortunately, few companies used this information. As a result, businesses often stumbled into disastrous situations. In the past, the failure to use knowledge was understandable, since it was so expensive to find; for example, less than three percent of published papers on forecasting provide useful knowledge. Furthermore, once relevant papers were found, it was difficult to understand the recommendations.

So, wouldn't it be nice if all useful knowledge about forecasting were provided in one convenient location? Better yet, wouldn't it be great if this knowledge was put into a form that could be used by forecasters. And why not provide it free of charge? Thanks to the Forecasting Principles Project, which was begun in 1996 with the aid of 40 researchers and 123 outside reviewers, this has now been accomplished: All useful knowledge on forecasting can be accessed through www.forecastingprinciples.com This is a bold claim, and I welcome people to challenge it. When they successfully challenge the claim, I will add their information to the site and again claim that it contains all useful knowledge about forecasting.

Panelists:

J. Keith Ord, McDonough School of Business, Georgetown University, Washington, D.C., USA, ordk@georgetown.edu

Eric Stellwagen, Vice President, Business Forecast Systems, Belmont, Mass., USA, estellwagen@forecastpro.com

Len Tashman, Director, Institute for Forecasting Education, Charlotte, Vermont, USA, www.forecastingeducation.com



Practitioner Track: Tuesday

Tuesday, 9:50 - 11:10 --- Room: Celestún

Practitioner Track Panel Discussion

Forecasting for Supply Chain and Enterprise Resource Planning

Panelists

Robert Fildes, Lancaster University Centre for Forecasting Lancaster, UK, r.fildes@lancaster.ac.uk

Paul Goodwin, The Management School, University of Bath, Bath, UK, mnspg@bath.ac.uk

Glen Margolis, Founder, Steelwedge, Inc, Pleasonton, CA, USA, glen@steelwedge.com

Supply chain planning and its management are dependent on accurate forecasts, both in the aggregate and at the detailed sku level. Such forecasts require data from all participants in the chain as well as the organization's marketing plans, and are produced by a mixture of statistical methods and managerial judgement. Improving their accuracy depends on better forecasting systems, clearer organizational responsibilities, including staffing, and of course the adoption of appropriate forecasting methods, including approaches for new products, shared seasonality, intermittent demand etc. Accurate and timely forecasts require that cutting-edge quantitative techniques be combined with emerging technologies that integrate, manage and share the wealth of data and intellectual capital that exists through the organization.

This panel will identify those areas that are most important in practice and where there is the greatest potential for improvement in supply chain and enterprise forecasts.



Tuesday, 11:25 – 12:25 --- Room: Celestún

Practitioner Track Tutorial

Beyond Exponential Smoothing: Using Event Indices to Model Promotions, Business Interruptions and other Aperiodic Events.

Presenter: Eric Stellwagen, Vice President, Business Forecast Systems, Belmont, Massachusetts, USA, estellwagen@forecastpro.com

This tutorial begins with an overview of traditional exponential smoothing models—providing a clear nonstatistical explanation of how these methods work and how they are applied. The session then explores event models—an extension of exponential smoothing that can incorporate promotional calendars, moveable holidays, business interruptions and other aperiodic occurrences.

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 has consulted 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 co-author of the Forecast Pro software product line and also serves as product manager.



Tuesday, 13:45 - 14:45 --- Room: Celestún

Practitioner Track Presentation

Two Examples in Applied Macroeconomic Forecasting

1. Forecasting Turning Points in Capital Spending

Presenter: Patrick Newport, Principal, Global Insight, Boston, Massachusetts, USA, patrick.newport@globalinsight.com

A downturn in business fixed investment (BFI)—business spending on equipment, software, and nonresidential structures--was the main contributor to the 2001 U.S. recession. In 2003, BFI is the sector delaying the expansion. This session discusses the business fixed investment equations in Global Insight's macro model. It also discusses how we account for intangibles such as the impact of corporate scandals, or uncertainty over the War in Iraq.

Newport, Patrick J. Patrick Newport's main role at Global Insight is to manage its U.S. macroeconomic model. He also tracks the investment and construction sectors, manages Global Insight 's long-term forecasts, and works on consulting projects.

Patrick joined Global Insight in July 1998. Prior to joining Global Insight, he worked as a research economist for Washington State's Department of Revenue. He later served as a senior economist for the Office of the Forecast Council of Washington State. Mr. Newport received his Ph.D. from Harvard University in 1993. He also holds a B.A. in Business Administration and an M.A. in economics from Louisiana State University. Patrick was born and raised in Boston, and now lives in Lexington Massachusetts, a Boston suburb.



2. Industry Price and Wage Modeling

Presenter: John Mothersole, Principal, Global Insight, Boston, Massachusetts, USA, john.mothersole@globalinsight.com

In forecasting industry price and wage inflation for more than 20 years, Global Insight has developed a relatively simple model of price change that offers a surprisingly rigorous framework within which to analyze price movements. This "Stages-of-Processing" methodology highlights the interplay of cost and markets forces in determining price change, and can be a powerful tool in identifying sources of cost pressure – statistically the most significant factor in explaining price movement over time.

We will review our stages-of-processing approach to forecasting prices with a focus on cost analysis as a way validating supplier prices. And we will reinforce our discussion by analyzing the cost structure of a selected industry during the presentation. Finally, we will close with "real world" examples of how our model has been used in supplier negotiations.

John Mothersole is a senior member of the Global Insight Industry Practice. He helps supervise the group's price and wage forecasts, is directly responsible for its nonferrous metal industry forecasts, and is an editor of the *Supply Manager*, the chief publication of the Pricing and Purchasing service. Other duties include inflation analysis for the Global Insight U.S. Economic Forecasting Service and, with the Industry Practice, project manager for a wide range of cost escalation and cost benchmarking studies.

In addition to his work with Global Insight clients, Mr. Mothersole has provided inflation analysis to *Fortune*, *Purchasing*, the *American Metal Market*, *Platts Metals Week* and the *Engineering-News Record*. He has also provided commentary on inflation for ABC News, the Nightly Business Report, the Dow Jones New Service's morning newscast and USA Today's First Business report.

Mr. Mothersole joined Global Insight in 1980 as an associate economist and has served in a number of positions within the Industry Practice. He received his B.A. and M.A. in Economics from the University of Maryland. Mr. Mothersole is a member of the National Association of Business Economists.



Tuesday, 15:00 – 16:00 --- Room: Celestún

Practitioner Track Tutorial

Rule Based Forecasting: Using Expert Knowledge to Combine Forecasts

Presenter: Monica Adya, Department of Management, Marquette University, USA, monica.adya@marquette.edu

Rule-based Forecasting (RBF) is an expert system that represents an accumulation of over four decades of forecasting practice as well as the domain knowledge of five experts. There are 99 rules in RBF and these are used to weight forecasts from four simple extrapolation methods.. These weights in turn are used to provide a combined forecast for a time series. In effect, RBF tailors forecasts to each series based on the characteristics of the time series. Comparisons across multiple independent samples, including data from the M3 competition, have shown that RBF produces more accurate forecasts than common benchmarks such as random walk and equal-weights combining.

In this session, I provide an overview of the development, validation, and use of RBF. The tutorial will illustrate how knowledge extracted from practice can be automated into efficient and effective rules of forecasting. We will discuss the process used to extract rules from experts, the codification and calibration of these rules, the validation of RBF, and the enhancements made to RBF since its inception in early 1990s.

Monica Adya is an Assistant Professor at the Department of Management, Marquette University. Her research interests include intelligent decision support systems, business forecasting, knowledge elicitation, and knowledge discovery in medical databases. She has published in *Information Systems Research, Journal of Forecasting, International Journal of Forecasting* among others. Monica is on the Section editor for the Research on Forecasting section of the *International Journal of Forecasting*. Monica received her doctorate in MIS from Case Western Reserve University in 1996.



Tuesday, 16:00 - 17:00 --- Room: Celestún

Practitioner Track Tutorial

How a Large Scale Macroeconomic Model can be used to Simulate the Effects of Major Economic Events

Presenters: Patrick J. Newport & Jeannine Tod, Global Insight, Boston Massachusetts, USA, patrick.newport@globalinsight.com, jeannine.tod@globalinsight.com

In this tutorial, Patrick Newport and Jeannine Tod of Global Insight (formerly DRI-WEFA) will explain the workings of Global Insight's 1,646 equation macroeconomic model of the United States and demonstrate how the model can be used to simulate the economic effects of (a) a tax cut (b) a change in the federal funds rate and (c) an oil price shock.

Patrick J. Newport Patrick Newport's main role at Global Insight is to manage its U.S. macroeconomic model. He also tracks the investment and construction sectors, manages Global Insight 's long-term forecasts, and works on consulting projects.

Patrick joined Global Insight in July 1998. Prior to joining Global Insight, he worked as a research economist for Washington State's Department of Revenue. He later served as a senior economist for the Office of the Forecast Council of Washington State. Mr. Newport received his Ph.D. from Harvard University in 1993. He also holds a B.A. in Business Administration and an M.A. in economics from Louisiana State University. Patrick was born and raised in Boston, and now lives in Lexington Massachusetts, a Boston suburb.

Jeannine Tod is Managing Director of Technology Applications at Global Insight. She joined the company is 1986 and is responsible for the product management of the company's time series statistical and economic analysis software applications.

Jeannine's 17 year career with Global Insight has spanned numerous roles in the organization. She has worked as a Research Analyst, Technical Support Manager, and Director of Software Applications. She has also traveled extensively training clients and Global Insight analysts in data access and analysis. Her primary role today in Product Management is to coordinate development of statistical tools for Global Insight economic and financial clients, internal economists and data analysts.

Jeannine graduated from Saint Joseph's University with degrees in Information Systems and Economics. She was born and raised in Philadelphia and lives in Penn Valley, a Philadelphia suburb.





Practitioner Track: Wednesday

Wednesday, 9:50 - 11:10 --- Room: Celestún

Practitioner Track Presentation

Pharmaceutical Forecasting: How to Optimize Sales Calls and Product Samples

1. Forecasting Methods for Targeted Sampling

Presenter: Sandy D. Balkin, Pfizer Inc, New York, USA, sandy.balkin@pfizer.com

Pharmaceutical companies often leave product samples with doctors as part of the promotional mix. One of the intents of product samples is to give a physician experience with a drug: however over-sampling can result in partial substitution for revenue generating prescriptions. The goal of this study is to use advanced forecasting methods as part of a process to determine a recommended number of samples per doctor per month. The business situation, data intricacies, and time urgency contribute to the complexities of this problem and are explained. The results show that a physician level forecasting system can cut down on over-sampling.

Sandy Balkin is senior manager and statistician at Pfizer, Inc., providing in-house quantitative modeling and analyses to address marketing and sales issues for primarily neurology products. He also serves as Adjunct Associate Professor of Statistics in the Stern School of Business, New York University, where he teaches the core MBA class on probability, statistical inference, and regression. He received his Ph.D from Penn State University in 2000.



2. Sales Forecast for a Pharmaceutical Product Based on Optimal Allocation of Sales Calls and Product Samples

Presenter: Alex Yaroshinsky, Connetics Corporation, Palo Alto, California, USA, ayaroshinsky@connetics.com

The objective of this paper is to demonstrate a sales forecasting methodology based on the optimal allocation of sales calls and product samples (call and sampling plans). The purpose of these plans was to increase sales and market penetration by assessing optimal quantities and allocation of calls and samples over time among 7200 physicians. We performed a trend analysis on new and total prescription data for different physician groups structured according to their market potential and market share. From this analysis, optimal number and allocation of sales calls and product samples was determined by building "response curves" based on the number of prescriptions as a function of number of calls and samples per physician for a given period of time. Sales forecast was built using dynamic regression model. Current sales force capacity was taken into account.

We were successful in designing optimal sales call and sampling plans as we have experienced a significant growth in sales of our products after implementation of this program.

Alex Yaroshinsky, Ph.D., Vice President of Quantitative Research and Biostatistics since January 2003, joined Connetics Corporation in 2000 as a Director of Biostatistics and Data Management. Dr. Yaroshinsky and his group are responsible for analytical support of sales and marketing, as well as product development organizations. Prior to Connetics, Dr. Yaroshinsky served as a consultant/principal statistician at Roche Bioscience, Inc., National Cancer Institute, and other pharmaceutical companies.



Wednesday, 11:25 – 12:25 --- Room: Celestún

Practitioner Track Tutorial

Forecasting and Time Series Analysis Using Non-Linear Models

Presenter: Patrick McSharry, Mathematical Institute, University of Oxford Department of Engineering Science, University of Oxford, UK, mcsharry@maths.ox.ac.uk

An improved understanding of many complicated processes can be achieved by analysing associated observed time series. While many time series are believed to have been generated by non-linear processes, practitioners are often reluctant to employ novel non-linear techniques instead of traditional linear methods. This is due to the fact that linear methods are usually well understood, are often simpler to use and have been tried and tested on many data sets. The increasing availability of computing power provides the opportunity for utilising non-linear methods despite their complexity. It is this complexity that can increase predictability, but can also lead to over-fitting problems. The advantages and disadvantages of non-linear models, particularly with regard to their selection, estimation and evaluation, when faced with observational uncertainty, are investigated. The importance of using appropriate statistical methods for non-linear models is discussed, noting that linear mean-squared error criteria are likely to unfairly reject non-linear candidate models. These methods are demonstrated using both synthetic and observed time series data.

Patrick McSharry is the Marie Curie research fellow within the Oxford Centre for Industrial and Applied Mathematics, which seeks to develop relations between mathematicians and industry, leading to high quality research with a practical basis. He has numerous publications on time series analysis, especially non-linear modeling of medical data. He received a D.Phil. in 1999 from the University of Oxford.



Schedule of Regular Program

Room	Yucatán III	Yucatán IV	Mérida II & III	Valladolid	Mérida I	Santa Lucía
Monday 16th						
8:30-9:30 Stable Seasonal Pattern Models						
9:50-11:10	Neural Networks I	Data Mining/ Econometric Methods	Modeling Volatility	Forecasting ir Transportation I	n Long n Memory Forecasting	Financial Forecasts
11:25-12:25	Forecasting Spot Prices	Macro Economic Forecasting I	Forecasting with Stable Seasonality	Telecomm Forecasting I	Modeling Business & Economic Cycles I	Long-Term Forecasting
13:45-14:45	Neural Networks II	Judgemental Forecasting I	Bayesian Forecasting	Forecasting Inflation I	Statistical Methods I	Demographic Forecasting
15:00-16:00	Forecasting Aspects in Volatile Time Series	Trend Modeling	Macro Economic Forecasting II	M3 Competition	Statistical Methods II	Econometrics
Tuesday 1	17th					
8:30-9:30	An Applica	tion of Fore	casting to Qu	ality Control	of Data	
9:50-11:10	Stock Market Forecasting	Forecasting and Leading Indicators in Euro-Area	Combining Forecasts	Forecasting in Transportation II	Long Memory Modeling	Neural Networks III
11:25-12:25	Data Quality and Forecasts	Judgemental Forecasting II	Data Mining	Bayesian Modeling	Forecasting Inflation II	
13:45-14:45	Forecasting and Social Issues I	Telecomm Forecasting II	Modeling Business & Economic Cycles II	Macro Economic Forecasting III		
15:00-16:20	Exponential Smoothing	Exchange Rates	Utilities Forecasting	Forecasting with GLM's	Statistical Methods III	
16:20-17:20	Poster Sess	ion (Free Bee	r and Cash Bar) a	at the Club de Ir	ndustriales	
Wednesda	ay 18th	1				1
8:30-9:30 Bayesian Prediction in Finance						
9:50-11:10	Nonlinear Dynamic Models	State Space Models	Judgemental Forecasting III	Signal Extraction: Boundary Problem	Forecasting for Replenishment Planning	
11:25-12:25	PANEL: Damping Works for Seasonality Estimates	Enterprise Forecasting	Accuracy of Economic Forecasts in Switzerland and Germany	Forecasting and Social Issues II	Macro Economic Forecasting IV	



Details of Sessions: Monday

Details of Sessions: Monday

Details of Sessions:

Monday

Session Chairs:

Please notice that session chairs for contributed paper sessions were picked as the last speaker of the session. This is the usual procedure in these meetings. We thank you for your cooperation.

Monday, 9:50 – 11:10 --- Room: Yucatán III

CONTRIBUTED SESSION: NEURAL NETWORKS I

Chair: Bruce Curry

BOOSTING TECHNIQUE WITH EVOLUTIONARY SEARCH OF WEIGHTS FOR THE IMPROVEMENT OF THE OUTPUT IN TIME SERIES PREDICTION.

E. Bautista-Thompson *

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The Prediction of Time Series has limits imposed by the properties of the Series (e. g. degree of chaos) and by the model characteristics of the Prediction Techniques. Each Prediction Technique is able to deal with a specific set of Time Series for which the Prediction Error is small, but for Time Series outside this specific set the Prediction Technique could generate predicted outputs with considerable error. In Time Series Prediction in order to improve the predicted output several methodologies has been developed that combines a group of predictors of the same nature, for example, the simple average of Statistical Models. In a similar way in Machine Learning, Boosting Algorithms (Weighted Predictor Vote) have been applied to increase the learning capability of Neural Networks for Classification and Regression Tasks. In this work, an evolutionary approach (Genetic Algorithm) has been developed in order to search for the weighted coefficients of a combination of non linear predictors (Neural Network and Non Linear Dynamics Techniques) that minimizes the Prediction Error (RMSE) of predicted outputs. This variant of a boosting algorithm is evaluated for a set of Time Series from different origins (Economy, Physics and Mathematics). **Keywords:** Time Series, Prediction Error, Machine Learning.

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NEURAL NETWORK MODELS FOR TIME SERIES FORECASTING: A REPLICATION OF THE HILL, REMUS AND O'CONNOR STUDY

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Hill, Remus, and O'Connor (1996) applied neural network models to 111 time series from the M-Competition. Their neural networks' performance on quarterly and monthly data was striking in that with a minimum of judgmental input, it outperformed the widely-used statistical methods with which it was compared, including naïve, Brown's exponential smoothing, Box-Jenkins modeling, Holt's, and a combination of six forecasts. We are aware of no research that has followed up on this encouraging result. We have developed a neural network that is specifically designed for time series forecasting and supports a wide variety of options. One of the simples of these replicates their procedure. Use of this version of the model is the first step in a program of research aimed at better understanding their results and extending their work by exploring alternatives not hitherto explored, with a view to improving the design of neural networks for time series forecasting. We will expand on the set of features used as inputs, explore additional processing heuristics, and enlarge the set of criteria used in making comparisons. In this talk, I will describe the issues that arose in designing our software and doing the replication. I will also present our results, and the direction of our research. **Keywords**: Back Propagation, Feature Identification, Neural Networks, Replication

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LINEAR LOCAL-GLOBAL NEURAL NETWORK MODEL: A NEW APPROACH FOR NON-LINEAR TIME SERIES MODELLING Mayte S. Fariñas* Department of Electrical Engineering, PUC-Rio, mayte@ele.puc-rio.br Marcelo Medeiros Department of Economics, PUC-Rio, mcm@econ.puc-rio.br Carlos E. Pedreira Department of Electrical Engineering, PUC-Rio, pedreira@ele.puc-rio.br

The past few years have witnessed a vast development of nonlinear time series techniques (Tong, 1990; Granger and Terasvirta, 1993). Among them, nonparametric models, a artificial neural network (ANN) and mixture of experts have been widely used. This paper proposes a new model, based on ANNs, named Local Global Neural Networks (LGNN). The main idea is to locally approximate the original function by a set of very simple approximation functions. The input-output mapping is expressed by a piecewise structure. The network output is constituted by a combination of several pairs, each of those, composed by approximation function and by a activation-level function. The activation-level function defines the role of an associated approximation function, for each subset of the domain. Partial superposition of activation level functions is allowed. In this way, modelling is approached by the specialization of neurons in each of the sectors of the domain. This formulation encompasses some already existing nonlinear models and can be interpreted as a mixture of experts model. We place emphasis on the linear expert case. The model is then called the Linear Local Global Neural Network (L²GNN) model. Based on Trapletti et al. (2000), we extensively discuss the theoretical aspects of the model: stationarity conditions, existence, consistency, and asymptotic normality of the parameter estimates, and model identifiability. A model building strategy, based on the use of information criteria, is also developed and the whole procedure is illustrated through applications to real time-series.

Keywords: non-linear models, neural networks, model identifiability, parameter estimation, model building

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NEURAL NETWORKS AND CHEBYSHEV POLYNOMIALS Bruce Curry*

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The Chebyshev polynomials are well known in the literature on numerical methods as an elegant method for approximating a given function. They can be regarded as being superior to Taylor series approximations. In one sense this is because a Taylor series offers a purely local approximation (at a given point), whereas Chebyshev polynomials operate over a specified interval. The end result is that it is generally possible to obtain a more parsimonious approximation, using fewer terms in the power series: a term used in the literature is 'economisation'. Another interesting property of the polynomials is orthogonality with respect to a certain weight function. Neural Networks are used because they can capture nonlinearities, through their capacity to approximate any 'reasonable' function. Unfortunately, this powerful feature comes at a price: the functional form of a feedforward network is rather intractable and involves under-identification of parameters. One way around this difficulty is to use approximation methods. Taylor series methods have been used by the author to investigate various features of the network: for example some simple functional interdependencies have been obtained. A Taylor approximation has been used by Teräsvirta to obviate the identification problem, fitting the network function using successive terms in a power series. The purpose of this paper is to show that the superior approximation properties of Chebyshev polynomials can be used to analyse various problems arising with feedforward networks. For example it is possible to cast some light on the problem of parameter identification: certain implicit dependencies between network weights may be obtained. The orthogonality property of the polynomials and the more parsimonious approximations which they provide also offer a potentially useful approach to the fitting process.

Keywords Neural Network, parameter identification, polynomial approximation, Chebyshev polynomial, Taylor series

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Monday, 9:50 – 11:10 --- Room: Yucatán IV

ORGANIZED SESSION: DATA MINING/ECONOMETRIC METHODS

Organizer and Chair: Annette Clauson

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THE EXPECTED BENEFITS OF DATA MINING. THE A.C. NIELSEN HOMESCAN PANEL DATA

Annette Clauson*

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Because the United States Department of Agriculture (USDA) is the lead Federal Government agency for nutritional information and programs of nutritional benefits for children and low-income households, the Economic Research Service (ERS) decided to organize and work with a team of experts to address the complex issues of why milk and more nutritious juices have been displaced by other non-alcoholic beverages. Low calcium intake among children and adolescents in the U.S. has become an emerging area of interest for policy makers in the U.S. They are concerned that the consumption of other beverages may contribute to higher calorie intake and obesity in children. This presentation will outline the steps necessary to mine the raw database (the 1999 A.C. Nielsen Homescan Panel), select the tools for working with patterns in the data, and choose the decision trees and econometric methods used to obtain information on the drivers of demand for milk and other non-alcoholic beverage products. The information from this study should result in developing nutritional and educational policies for analyzing, forecasting, and setting priorities in food program changes.

Keywords: non-alcoholic beverages, nutritional information, milk.

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PROCEDURES FOR PREPARING THE A.C. NIELSEN DATA FOR DATA MINING AND ANALYSIS Grant Pittman* Texas A&M University, gfpittman@ag.tamu.edu Mathew Stockton Texas A&M University, Mcstockton@ag.tamu.edu

Non-alcoholic beverages are frequently purchased items by U.S. households and occupy a notable share of the food dollar. This presentation will outline the necessary steps, software, tools, and data trouble-shooting techniques (including working with outlying, influential, and missing data points) used in preparing the data set for this project, the 1999 A.C. Nielsen Homescan Panel. Some of the steps include: finding all data modules pertaining to non-alcoholic beverages; running frequencies on the modules to obtain the number of records; converting all of the non-alcoholic beverages into the same unit of liquid gallons; obtaining a price per gallon for each record; aggregating the data modules into broader categories; determining statistical methods for dealing with outliers and zero expenditures; and merging the household identification, demographic information, and data modules into one data set. After combining the information, individual household monthly, quarterly, and annual purchases of non-alcoholic beverages are estimated and used in the demand estimations.

Keywords: data modules, trouble-shooting techniques, outliers.

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NONALCOHOLIC BEVERAGE CONSUMPTION NUTRITION ISSUES Joanne Guthrie*

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Nutrition and health issues are major concerns for the U.S. Federal government when evaluating effects of government food assistance programs. The demand for non-alcoholic beverages by different income segments and within various household compositions is a nutritional concern for the government. If calcium intake (through milk and fortified fruit juices) is displaced by other non-alcoholic beverages, what are the nutritional implications and how do beverages (milk, fruit juices and drinks, ready to drink tea, bottled water, carbonated beverages, coffee, and sport drinks) interplay within households of know composition? In this presentation, the nutritional issues of calories, calcium, caffeine, and Vitamin C for different household sizes and income levels will be discussed as they relate to developing nutrition and education policies and setting priorities for program changes.

Keywords: Nutrition, Calcium, Vitamin C.

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DETERMINING THE DRIVERS OF DEMAND FOR THE NONALCOHOLIC BEVERAGE COMPLEX Oral Capps, Jr.*

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The overall objective of this project was to improve the understanding of the displacement of milk and more nutritious juices by soft drinks and other beverages in the U.S. After the household scanner data were collected, and the decision trees on preparing the data were evaluated, applied statistical techniques and econometric methods for analyzing the data were explored and analyzed. This presentation will provide information on the drivers of demand for milk (flavored and non-flavored); fruits juices and drinks; tea; coffee; bottled water; powdered soft drinks; and carbonated soft drinks in the U.S. for households of different incomes and sizes. Estimates of own-price, cross-price, and income elasticities of demand for the non-alcoholic beverage complex will be presented. The elasticities will be based on demand system analysis with censored observations.

Keywords: Applied statistical techniques, econometric methods, income elasticities, demand system analysis.

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Monday, 9:50 – 11:10 --- Room: Mérida II & III

CONTRIBUTED SESSION: MODELING VOLATILITY

Chair: Alejandro Islas Camargo

FORECASTING STOCK MARKET VOLATILITY: EVIDENCE FROM FOURTEEN COUNTRIES

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This paper evaluates the out-of-sample forecasting accuracy of eleven models for weekly and monthly volatility in fourteen stock markets. Volatility is defined as within-week (within-month) standard deviation of continuously compounded daily returns on the stock market index of each country for the ten-year period 1988 to 1997. The first half of the sample is retained for the estimation of parameters while the second half is for the forecast period. The following models are employed: a random walk model, a historical mean model, moving average models, weighted moving average models, exponentially weighted moving average models, an exponential smoothing model, a regression model, an ARCH model, a GARCH model, a GJR-GARCH model, and an EGARCH model. We first use the standard (symmetric) loss functions to evaluate the performance of the competing models: the mean error, the mean absolute error, the root mean squared error, and the mean absolute percentage error. According to all of these standard loss functions, the exponential smoothing model provides superior forecasts of volatility. On the other hand, ARCH-based models generally prove to be the worst forecasting models. We also employ the asymmetric loss functions to penalize under/over-prediction. When under-predictions are penalized more heavily ARCH-type models provide the best forecasts while the random walk is worst. However, when over-predictions of volatility are penalized more heavily the exponential smoothing model performs best while the ARCH-type models are now universally found to be inferior forecasters.

Keywords: Stock market volatility, forecasting, forecast evaluation

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NEO-NORMAL STOCHASTIC VOLATILITY MODELS WITH AR(2) VOLATILITY PROCESS Khreshna Syuhada* Institut Teknologi Bandung, khreshna@dns.math.itb.ac.id Gopalan Nair

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In stochastic volatility (SV) modeling of financial returns, the volatility process is often modeled as first-order autoregressive or AR(1) process. However, Asai (2000) has shown that the lag length of model for volatility process is two instead of one. Accordingly, we propose a new SV model that specify an AR(2) process for the model of volatility. For error process, we employ normal distribution as well as neo normal distributions as in Nair and Syuhada (2002). Our aim is to study the effect lag length change in model for volatility process for both persistence parameter estimate and stylized facts of returns, such as predicted kurtosis and autocorrelation coefficient of squared returns. Empirical analysis using daily stock returns from several Australian Stock Exchange (ASX) listed companies shows that there is an increase of persistence parameter estimate under SV models with AR(2) volatility process. In addition, the predicted kurtosis of the model is compatible with empirical data and the predicted autocorrelation coefficient of squared returns is lower compared to SV models with AR(1) volatility process.

Keywords: stochastic volatility, second-order autoregressive, neo-normal distribution.

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FORECASTING VOLATILITY USING A CONTINUOUS TIME MODEL Maria Helena Lopes Moreira da Veiga*

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This paper evaluates the forecasting performance of a continuous stochastic volatility model with two factors of volatility (SV2F) and compares its volatility forecasts to the forecasts obtained from the traditional GARCH and ARFIMA models. The empirical results show that the volatility forecasting ability of the SV2F model improves over the GARCH and ARFIMA models, specially when volatility seems to change pattern. I use as a proxy of ex-post volatility the realized volatility obtained from intraday data and the volatility forecast of the SV2F is calculated recurring to the reprojection technique proposed by Gallant and T\bigskip auchen (1998). **Keywords:** Efficient Method of Moments (EMM), Reprojection, Factors of Volatility, Fractional Integration, Volatility

Forecasting.

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LONG-MEMORY VOLATILITY IN LATIN AMERICAN STOCK MARKETS Alejandro Islas Camargo*

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This paper investigates the existence of long memory in the volatility of the six largest and least restrictive Latin American stock markets, as well as that of the U. S. as a useful empirical benchmark. We find strong evidence of long memory in the volatility of the return rates on the indexes of the stock markets of Argentina, Brazil, Chile, Mexico, and the U. S., while the cases of Colombia and Venezuela reject a long-memory specification of the volatility. We use stochastic volatility (SV) models to test for changes in volatility. In this case, estimation is carried out through the Kalman filter (KF) and the improved quasi-maximum likelihood (IQML). We also test for both persistence and long memory by using a long-memory stochastic volatility (LMSV) model, constructed by including an autoregressive fractionally integrated moving average (ARFIMA) process in a stochastic volatility (SV) scheme. Under this framework we work up maximum likelihood spectral estimators and bootstraped confidence intervals. **Keywords:** econometric modeling; testing and estimation; international investment.

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Monday, 9:50 – 11:10 --- Room: Valladolid

ORGANIZED SESSION: FORECASTING IN TRANSPORTATION I

Organizer and Chair: Brian Sloboda

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GREENHOUSE GAS (GHG) DATA & MODELS

David Chien*

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Since the Kyoto Protocol in 1997, greenhouse gas forecasting has been very prevalent in the news media and the literature. Several forecasts in the past have been made by the U.S. Federal Government at the request of the President and Congress to estimate the future greenhouse gas emissions from the Transportation Sector. Essential to the debate on greenhouse gases, are the models and the data that drive the results. The following presentation will review some of the data available to measure greenhouse gas emissions from the U.S., and the statistical models that the U.S. Federal Government uses to evaluate potential greenhouse gas policies and generate greenhouse gas forecasts. Most of the material contained in this presentation, has been individually collected by the author, with some supplemental additions from current research work at the Department of Transportation.

Keywords: Gas emissions.

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LEADING AND COINCIDENT INDICATORS FOR THE U.S. TRANSPORTATION SECTOR

Kajal Lahiri* Department of Economics, SUNY-Albany, klahiri@albany.edu Wenxiong Yao Department of Economics, SUNY-Albany Peg Young Bureau of Transportation Statistics, U.S. Department of Transportation, peg.young@bts.gov

Since most of final and intermediate goods in an economy are moved by the transportation sector, indicators of this sector may have strong forecasting value for the overall economy. We have developed a monthly index of coincident indicators and an index of the leading indicator that throw light on the current status of the transportation sector and its future prospects. Four coincident indicators (transportation output as developed by Lahiri et al. (2002), employment, payroll, and personal consumption expenditure), and a number of leading indicators from the transportation equipment and the manufacturing sector are selected following standard leading economic indicator approach for the overall economy. Composite coincident index is constructed using both the conventional NBER approach and a regime-switch state space model using Gibbs-sampling methodology. We first identify the business cycle chronology for the U.S. transportation sector. Then the selection of leading indicators is rationalized, and a composite leading index is constructed. The growth cycles in the U.S. transportation sector are compared with those of the overall economy. **Keywords**: Business cycle.

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ESTIMATION OF INTERNATIONAL TRADE TRAFFIC ATTRIBUTES ON U.S. HIGHWAYS Caesar Singh*

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As the world's largest trading nation, the United States is both the largest importer and exporter of merchandise. With the growth of international trade, the condition and suitability of the nation's freight transportation infrastructure continue to be a transportation challenge. This presentation illustrates procedures that were adopted to estimate freight movement attributes such as ton-miles and value-miles on U.S. highways through use of existing data and application of mathematical modeling techniques. Furthermore, it addresses it addresses the reliability and accuracy of these estimates along with data improvement recommendations. **Keywords**: Mathematical modeling.

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THE EFFECTS OF TERRORISM ON TOURISM: A REGIONAL ANALYSIS OF THE UNITED STATES, THE EUROPEAN UNION, AND MEDITERRANEAN NATIONS Brian Sloboda*

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In the 1980's and 1990's there has been an increase in the number of heinous terrorist events that made tourists in the United States and abroad wary of traveling. As a consequence, these tourists travel less to countries which are plagued by terrorism and travel to less target countries. The analysis of Sloboda (2002) employed an ARMAX model to assess the effects of terrorism on tourism on the United States. ARMAX models allow for the assessment of the shape of the lag distributions of the impacts of terrorism on tourism via a ratio of the lag of polynomials for the tourism data and the number of terrorist incidents. ARMAX models are single equations and only provide useful analysis of the short-term relationships between tourism and incidents of terrorism. The present analysis will examine the cross-country effects of terrorism on tourism, and the countries to be incorporated into the analysis will be from European Union and the Mediterranean region plus the United States. The model will specify a time series model, which is estimated by using a seemingly unrelated regressions (SUR) model.

Keywords: Time series model.

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Monday, 9:50 - 10:50 --- Room: Mérida I

CONTRIBUTED SESSION: LONG MEMORY FORECASTING

Chair: Nizam de Abreu Pfeilsticker

ANALYSIS OF CONCENTRATION FLUCTUATION OF THE ATMOSPHERIC POLLUTANTS USING THE LONG MEMORY STOCHASTIC MODELS

Reginaldo de Paula*

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The study of the atmospheric dispersion of pollutants around building is an important research topic related to air pollution. The analysis of the concentration data series shows a slowly declining correlogram and infinite spectrum at zero frequency In this work the long memory characteristics of concentration fluctuation time series for atmospheric pollutants is investigated.. The time series of turbulent concentration fluctuation on the surface of an isolated building was obtained from field experiments conducted by Santos (2000). The main objective of this study is model the concentration series by using a ARFIMA (p,d,q) process based on estimators for the long memory fractional parameter d. The method of the smoothed periodogram (Reisen, 1994) is used to estimate of the parameter d. The ARFIMA models obtained are used to evaluate the variance of the theoretical errors and to perform concentrations forecast k-steps ahead.

Keywords: long memory, atmospheric pollutants, forecasting

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THE POWER OF FRACTIONAL PARAMETER TESTS ON NON-COINTEGRATED PROCESSES Luz Amanda Melgar Santander*

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This work investigate through Monte Carlo simulation the use of statistic test of several semiparametric fractional estimators as tests for non-cointegration. The critical values for the tests are generated for different sample sizes and model structures because they are non standard. The results indicate that tests are not robust when the standard critical Normal values are used to test the null hypothesis of non-cointegration. The power function of the tests for unit root and fractional non-cointegrated processes is presented. The ADF test is used for comparison purpose. Some semiparametric fractional estimator tests have indicated to be more powerful than the usual ADF test especially for small sample size.

Keywords: Cointegration, Estimation, Long memory, ARFIMA model.

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COMPUTATIONAL ASPECTS OF MAXIMUM LIKELIHOOD ESTIMATES OF LONG MEMORY TIME SERIES MODELS Nizam de Abreu Pfeilsticker* Universidade Federal de Minas Gerais, nizam@terra.com.br Ela Mercedes Medrano de Toscano Universidade Federal de Minas Gerais,mercedes@est.ufmg.br Valdério Anselmo Reisen Universidade Federal do Espírito Santo, valderio@verao.cce.ufes.br - UFES

The computational aspects of the maximum likelihood estimator, proposed by Fox-Taqqu, of the ARFIMA (p,d,q) is the main motivation of the results presented in this paper. The investigation is based on simulation study for different sample sizes and model parameters. Our study indicates that the use of FT requires some caution depending specially on the structure of the processes and suggests the use of FT as a second step to estimate the final parameter in the ARFIMA model.

Keywords: ARFIMA, Estimation, Maximum Likelihood, Long Memory

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Monday, 9:50 – 11:10 --- Room: Santa Lucía

CONTRIBUTED SESSION: FINANCIAL FORECASTS

Chair: Douglas D. Mooney

REVENUE PREDICTION BASED ON HISTORICAL PATTERN IDENTIFICATION AND MODELING

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Businesses today are under intense pressure to compete in an environment of low visibility, tight deadlines and reduced profits. One key to being successful in this environment is having timely and accurate financial and other business performance data that reflects the state of the corporation. It would be difficult for a modern enterprise to be successful without accurate gathering and analysis of its financial data. As we know, financial data is usually maintained in computerized financial reporting systems. For some large entities, these reporting systems process large numbers of complex transactions occurring at locations around the world. In exploring this huge database for determining the behaviors of some financial metrics such as revenue, we found that modeling the complex financial transactions of the large enterprise can be very difficult. Nevertheless, decision makers are now in an ever-increasing need for rapid decision support based on accurate analysis and prediction of future behavior of financial metrics in this particularly low visibility environment. At HP, we have successfully developed a complete solution for addressing this urgent and important business problem. In this article, we present a solution that provides accurate and timely prediction of revenue. More specifically, a method and system is developed to predict a behavioral revenue value for a forecast period based on historical pattern identification and modeling (PIM). A set of training periods is compiled, and for each of the training periods, a generalized percentage function of the behavioral values is defined and computed. The training periods and their corresponding generalized percentage functions are further normalized and generalized, respectively, according to certain criteria. A prediction time series is computed from the generalized percentage functions, and is then used to forecast a set of values in the forecast period based on the most current behavior value that we have observed.

Keywords: Prediction, Financial Metrics, Pattern Identification and Modeling (PIM)

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FORECASTING COMPARATIVE PERFORMANCE OF DOMESTIC EQUITY MUTUAL FUNDS USING TURNOVER RATES Albert E. DePrince, Jr.*

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Mutual funds have become an increasingly important investment vehicle in recent years, but among the funds, actively managed funds grew in number and size far faster than indexed funds. By December 2001, actively managed stock and bond funds totaled \$4,245 billion compared with a scant \$333 billion in indexed funds. At the same time, the theory of efficient markets argues that active portfolio management cannot produce results superior to the market as a whole in the long run. This argument stands in contrast to the very rapid growth in actively managed funds, and suggests that investors feel that active management can enhance return over what would be earned with passive asset management, i.e., indexed funds. In response to this seeming dichotomy, this study seeks to determine the extent to which active management enhances returns. In it, the degree of management activity is measured by a fund's turnover rate. The ratio loosely represents the percentage of the portfolio's holdings that have changed over a given period, e.g., a quarter, reported at an annual rate. The null hypothesis is that turnover and performance are positively related. The paper's model assesses the contribution made by turnover to domestic funds' return, controlled for asset classification (large-, mid-, and small-cap funds) and investment style (growth, blend, and value investment styles). The study also stratifies by true no-load funds and load funds. Additionally, returns are measured with and without effects of 12b-1 fees, i.e., distribution fees that are charged against funds' asset values each year. Year-end data for 2000, 2001, and 2002 are used, and a pooled approach is employed in the assessment. For year-end 2001, there were 6,862 domestic equity funds. The number used in the study will likely be less, since a common group of funds for all three years must be established. Keywords: mutual funds, investment performance, portfolio turnover rates

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THE OPTIMIZATION OF EFFICIENT PORTFOLIOS: THE CASE FOR AN R&D QUADRATIC TERM John B. Guerard, Jr.

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In this study, we produce mean-variance efficient portfolios for various universes in the U.S. equity market, and show that the use of a composite of analyst earnings forecast, revisions, and breadth variable as a portfolio tilt variable and an R&D quadratic term enhances stockholder wealth. The use of the R&D screen creates portfolios in which total active return generally rise relative to the use of the analyst variable. Stock selection may not necessarily rise as risk index and sector index returns are affected by the use of the R&D quadratic term. R&D expenditures of corporations may be integrated into a mean-variance efficient portfolio creation system to enhance stockholder returns and wealth. The use of an R&D variable enhances stockholder wealth relative to the use of capital expenditures or dividends as the quadratic term. The stockholder return implications of the R&D quadratic variable are particularly interesting given that most corporations allocate more of their resources to capital expenditures than R&D. **Keywords**: Earnings Forecasting, Portfolio Analysis, Optimization

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UNSTRUCTURED DATA IN PREDICTIVE MODELS OF MORTGAGE PAYMENT BUCKETS Nancy J. McMillan Battelle, mcmillann@battelle.org Douglas D. Mooney* Battelle, mooneyd@battelle.org

Unstructured data sources such as newspapers, websites, and internal corporate communications contain information that could improve the predictive ability of models if there were a mechanism for utilizing this information. This paper details a pilot project that combined data from unstructured sources with traditional structured data in a model to predict mortgage default risks. The payment classes (buckets) of a large portfolio of single-family residential mortgages were modeled with a non-stationary Markov model which predicts transitions between the payment states from month to month. One year of payment history data for mortgages from two Metropolitan Statistical Areas were available with the following payment states: current, one month late, two months late, three months late, not performing, and default. The transition matrix of the Markov process was modeled as a function of explanatory variables specific to each loan, e.g., FICO score of applicant, and published or proprietary external explanatory variables that change over time such as unemployment rate, rate of new unemployment claims, and probability of recession. The model predicts the probability of each payment class for each loan in the portfolio for several months into the future. Based on the predicted monthly transition probabilities for each loan, other performance metrics of interest (specifically those related to default risks such as the total dollar value of default losses expected over the next six months) can be estimated along with their associated uncertainties. News stories related to the economy were harvested from newspaper websites. The harvested unstructured data were converted to structured vectors containing the relative prevalence of economic themes over time. These variables were used as time varying explanatory variables in the model. The model with harvested variables performed better than the model with published or proprietary explanatory variables only. Keywords: Unstructured data, Markov model, Prediction.

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Monday, 11:25 – 12:25 --- Room: Yucatán III

CONTRIBUTED SESSION: FORECASTING SPOT PRICES

Chair: Roy Batchelor

USING LINEAR AND NON-LINEAR APPROACHES TO MODEL THE BRAZILIAN ELECTRICITY SPOT PRICE SERIES

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In this article, modelling strategies are presented involving linear and non-linear time series models to forecast the spot price of brazil's electrical energy market. It has been used, among the linear models, the modelling approach of harvey (1989) i.e., structural models, that extracts non-observable components of the series. Three models were elaborated. The first one was adjusted only with the historical values of the series. In the second, an intervention variable for the energy shortage occurred in brazil between june of 2001 till february of 2002 was inserted. Finally, in the last one, two explanatory variables were introduced. Among the non-linear ones, the chosen model was the *lstar* developed, initially, by chan and tong (1986) and, later, by teräsvirta (1994). For this model, the lagrange multipliers test, to measure the degree of non linearity of the series, as well as to evaluate the estimated model was used. Moreover, it was also used a proposal for the initial values of the optimisation algorithm, developed by medeiros (2000). The smoothed kalman filter estimates were used in order to provide values for the spot price series during the energy shortage period the work is pioneering in brazil and the obtained results are very satisfactory when compared with results for other price series. **Keywords**: structural model, lstar model, spot price series, electricity market

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OUT-OF-SAMPLE PERFORMANCE OF NON-PARAMETRIC GROWTH CURVE MODELS: THE CASE OF FORECASTING WORLD PRICES OF PRIMARY METALS

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This paper compares the forecasting performance of parametric and non-parametric growth curve models in the context of predicting monthly world prices of primary metals produced by developing countries. Forecasting performance is evaluated by using the root mean squared error and the absolute mean square error criterion applied to the out-of-sample data, which is used to simulate forecast performance. **Keywords**: Root mean squared error.

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FORECASTING PERFORMANCE OF SPOT AND FORWARD PRICES IN THE FREIGHT MARKET Roy Batchelor* Cass Business School, City of London, r.a.batchelor@city.ac.uk Amir Alizadeh Cass Business School, City of London, a.alizadeh@city.ac.uk Ilias Visvikis

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This paper we investigate the performance of different time-series models in generating joint short-term forecasts of spot prices and Forward Freight Agreement (FFA) prices recorded in the international shipping market. This market is interesting for two reasons. First, the freight rate forward market relates to in a non-storable instrument (shipping services), and hence - unlike more conventional futures prices - FFA prices cannot be expected to revert to some value determined by the cost of carry. Second, and consequently, FFA prices may reveal traders expectations about future spot rates, so that spot rates revert to futures prices. However, because the market is young and relatively illiquid it is an empirical question how efficient this "price discovery" function is. We analyse a unique database of forward rates drawn from the records of a leading London broker. To allow for the possibility of convergence of spot on forward prices, we examine the forecasting performance of a Vector Error-Correction Model of spot and FFA prices. The forecasts from this model are compared to forecasts generated by Vector Autoregressive, Seemingly Unrelated Regression Estimation VECM, Autoregressive Moving Average (ARIMA), and Random Walk models. Following Tashman (2000), we create independent non-overlapping forecasts by generating N-period ahead multiple forecasts. Our results suggest that forward freight rates do embody expectations, and can be used to improve spot rate forecasts. Conditioning spot returns on lagged FFA returns generates more accurate forecasts of the spot prices for all forecast horizons. However, conditioning FFA returns on lagged spot returns enhance the forecasting accuracy of FFA prices only up to 4-days ahead. For longer forecast horizons benchmark univariate ARIMA models produce more accurate forecasts of forward prices than the bivariate models.

Keywords: Forecasting; Futures Markets; Freight Rates

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Monday, 11:25 – 12:25 --- Room: Yucatán IV

CONTRIBUTED SESSION: MACROECONOMIC FORECASTING I

Chair: Charles Bowman

FOREIGN DIRECT INVESTMENT AND FIRMS' FINANCING CONSTRAINTS AROUND THE WORLD: CROWDING IN OR CROWDING OUT? Juan A. Cárdenas-Chávez *

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Firms operating in emerging market economies often appear to be financially constrained. It has been argued that by letting in (and out) capital flows of foreign direct investment (FDI) and thus the establishment of multinational companies domestic firms will be better off. It may be the case that multinational companies bring capital and new funding sources to the host country alleviating financing constraints for domestic firms, however, multinational enterprises may use domestic institutions in order to obtain scarce capital for their investment projects hence crowding out domestic firms from local capital or credit markets. By using an ordered logit model and data from a World Bank survey of more than 10,000 firms in 80 different countries as well as time series data on FDI inflows, this study will present evidence in order to assess whether domestic firms operating in countries with substantial FDI inflows tend to be more financially constrained or not.

Keywords: Foreign direct investment, financing constraints.

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FORECASTING REGIONAL ECONOMIC ACTIVITY WHEN THE REFERENCE SERIES ARE SHORT: A CASE STUDY José Ramón Cancelo Universidade da Coruña (Spain), jramon@udc.es Antoni Espasa * Universidad Carlos III de Madrid (Spain), espasa@est-econ.uc3m.es

Forecasting real economic activity at a regional level is a basic need in decentralised economies, where regional authorities may set up discretionary policies to offset asymmetric cyclical shocks. However, it is not common to find adequate regional macroeconomic information. In particular, the reference series are usually too short to replicate the same forecasting methodology that is used to produce short and medium-term predictions for the national economy, on a regional level. In this paper we present the procedure we follow to derive current to two-year ahead forecasts for Comunidad de Madrid (Spain). The basic aim is to predict the annual rate of growth of the economy. Regional economic accounts are annual and only available for the 1993-2001 period; short-term indicators are monthly or quarterly, they do not cover the whole range of economic activities and, although most of the series start in the 80's, there are some basic indicators that begin in 1993-1994. This informational framework heavily restricts the forecasting methods that may be considered. We proceed at the sectorial level and consider five sectors: primary, industry, construction, market services and non-market services; a finer sectorial disaggregation is not possible because of the lack of valid indicators. To derive forecasts for sectorial added value, we combine a dynamic factor model with quarterly data and a dynamic regression with annual data. The factor model enables us to summarise all the intra-annual information concerning the indicators; in the regression with annual data, we consider consensus forecasts for the national economy, which are also useful when forecasting regional output because of the close links between the two economies. The final prediction of regional GDP is obtained by sectorial aggregation. Keywords: regional forecasting, factor models, sectorial disaggregation, Madrid

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COEFFICIENT CHANGE IN INPUT-OUTPUT FORECASTING MODELS Charles Bowman*

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Input-output techniques are widely used in economic forecasting models that combine economy-wide scope with a high degree of industrial detail. One of the problems that arise in such models is the treatment of coefficient change. Can coefficients be treated as fixed or do they change systematically over time? If they are changing, is the variation sufficiently large to affect forecasts of industrial output, employment and the like? Finally, what approaches are available to forecast coefficient change if this is warranted? In the first part of the paper we utilize a series of annual input-output tables developed by the U.S. Bureau of Labor Statistics to examine empirically both coefficient stability and the potential contribution of coefficient change in input-output models. We then examine various techniques that have been developed to deal with coefficient change in input-output models. We conclude with an evaluation of these techniques and suggest factors that might influence the choice of technique in specific applications. **Keywords:** Economic forecasting, Input-output

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Monday, 11:25 – 12:25 --- Room: Mérida II & III

ORGANIZED SESSION: FORECASTING WITH STABLE SEASONALITY

Organizer and Chair: Enrique de Alba

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A FORECASTING METHOD FOR EVENTS WITH STABLE SEASONALITY

Enrique de Alba*

Department of Actuarial Science and Insurance, ITAM, dealba@itam.mx José Nieto de Pascual⊕

The problem of estimating the accumulated value of a positive and continuous variable for which some partially accumulated data has been observed, and usually with only a small number of observations (two years), can be approached taking advantage of the existence of stable seasonality (from one period to another). For example the quantity to be predicted may be the total for a period (year) and it needs to be made as soon as partial information becomes available for given subperiods (months). These conditions appear in a natural way in the prediction of seasonal sales of style goods, such as toys; in the behavior of inventories of goods where demand varies seasonally, such as fuels; or banking deposits, among many other examples. In this paper, the problem is addressed within a cluster sampling framework. A ratio estimator is proposed for the total value to be forecast under the assumption of stable seasonality. Estimators are obtained for both the point forecast and the variance. The procedure works well when standard methods cannot be applied due to the reduced number of observations. Some real examples are included as well as applications to some previously published data. Comparisons are made with other procedures. **Keywords**: Stable Seasonality, Ratio Estimator , Forecast, Partial Accumulation, Sampling

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FORECASTING METHODS FOR SHORT TIME SERIES WITH STABLE SEASONALITY Laura Malváez*

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When a forecasting analyst faces the lack of historical data of a variable, the question that commonly arises is: which method is more accurate to forecast the future pattern of such variable? The most popular forecasting techniques for time series with stable seasonality are reviewed within this presentation, including their assumptions and implementation requirements. To illustrate specific applications of these techniques, forecasting results of three time series of different nature are obtained in order to solve a particular problem: estimation of the year-end-total of a variable given a few (one or two) years of monthly past data and some from the current year. The forecasting performance of each technique is measured by means of statistical criteria. This serves, as introduction to some innovative forecasting methods, specifically developed to deal with this information shortcoming. **Keywords**: Short Time Series; Stable seasonality

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A BAYESIAN FORECASTING METHOD FOR SHORT TIME SERIES WITH STABLE SEASONAL PATTERNS Manuel Mendoza* Department of Statistics, ITAM, mendoza@itam.mx Enrique de Alba Department of Actuarial Science and Insurance, ITAM, dealba@itam.mx

The problem of forecasting a time series with only a small amount of data is addressed within the Bayesian framework. The quantity to be predicted is the accumulated value of a positive and continuous variable for which some partially accumulated data has been observed. These conditions appear in a natural way in the prediction of sales of style goods and many other situations. A very simple model is proposed to describe the relation between the partial and the total values of the variable to be forecasted under the assumption of stable seasonality. Stable seasonality is specified in stochastic terms. Analytic results are obtained for both, the point forecast and the entire posterior predictive distribution. The proposed technique does not involve any approximation. It allows the use of non-informative priors so that implementation may be automatic. The procedure works well when standard methods cannot be applied due to the reduced number of observations. It also improves on previous results published by the authors. Some real examples are included.

Keywords: Stable seasonality, Bayesian, Forecast, Time series

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Monday, 11:25 – 12:25 --- Room: Valladolid

ORGANIZED SESSION: TELECOMM FORECASTING I

Organizer and Chair: Robert Fildes

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A SEGMENTAL APPROACH TO FORECASTING HOUSEHOLD INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) ADOPTION RATES: AN ANALYSIS OF THE BRITISH ICT MARKET Alastair Robertson

Lancaster University Management School, UK arobertson@mistral.co.uk Didier Soopramanien Lancaster University Management School, UK, D.Soopramanien@Lancaster.ac.uk Robert Fildes* Lancaster University Management School, UK, R.Fildes@Lancaster.ac.uk

Residential computer and Internet adoption has now stalled in the UK. Contrary to this finding, broadband adoption is increasing beyond expectation. These observations highlight the importance of measuring current consumption habits of existing ICT users, and critically, the perceptions of those not yet in the marketplace. Using a sample base of 1500 households, this paper shows that computer and Internet choice adoption probabilities can be generated using nested logit models at the consumer segment level that are generated using individual level socio-demographic factors and market attribute data. Segmentation is undertaken using consumer perceptions of the technology itself. An advantage of this approach is that segmental price and income elasticity's can be computed that highlight the idea that some consumers are much less likely to adopt than others, exemplifying differential income and price sensitivities between distinct consumer segments. The next stage is to generate segmented probabilities to include into diffusion processes that can then be used to forecast adoption levels in the years ahead.

Keywords: Internet adoption, Market segmentation, Diffusion of Innovations

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MODELLING AND FORECASTING MULTI-GENERATION, MULTI-COUNTRY, MOBILE PHONE ADOPTION

Towhidul Islam*

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A multi-country model of mobile phone adoption is presented that simultaneously considers the two current generations of mobiles available. The adoption of the first generation of analogue 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 analogue users. The multi-country approach allows the use of cross-sectional information that will enhance the forecasting in late adopting countries. Country-specific variables describing the national environment are used to model saturation levels. The forecasts from this combined model are compared with univariate growth curve forecasts and Holt's linear trend model.

Keywords: Multigeneration, Multi-country, Mobile Phones, Diffusion of Innovations

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EVOLUTIONARY ESTIMATION OF MACRO-LEVEL DIFFUSION-BASED FORECASTING MODELS USING GENETIC ALGORITHMS: AN ALTERNATIVE TO NON LINEAR LEAST SQUARES Rajkumar Venkatesan

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A typical new product sales growth data set carries an inherent shortcoming in that the number of data points available for forecasting is much less than one would like to have typically for any empirical estimation. This is because we have access to only annual sales data and the interest in the new product reduces considerably after the peak sales period (which is around 8 years for most new consumer durables). The small sample size of the diffusion data makes the estimation more challenging, especially if the model-concerned has more than 3 parameters. Although Nonlinear Least Squares (NLS) is the most widely used technique, many issues have also been raised. The estimation issues of NLS can be classified into data length related and model related. With respect to data length related issues, first, one is unlikely to get reliable estimates or even convergence if the NLS technique is used on a data set that doesn't contain the peak sales data point, i.e., when the product is still in the growth stage. Second, the starting values for the parameters have to be judiciously selected to ensure convergence and global optima, when using data that contains information until peak sales. Third, a more recently reported issue (Van den Bulte and Lilien 1997) is that the parameter estimates are biased and change in a systematic fashion as one adds data points during the maturity/decline phase of product life cycle. Finally, with respect to model related issues, to apply NLS one needs to have a closed form solution for cumulative penetration in the diffusion model. In this paper, we propose a simulation based estimation algorithm, namely, Genetic Algorithms (GA) as an alternative. GA is devoid of all the four issues involved with NLS estimation even though the objective function we use therein for optimization is identical to that of the NLS (i.e., obtaining minimum sum of squared errors). Further, GA retains a very useful property of the time invariant parameters, namely, the ease of carrying out what-if analyses. We also find that the standard errors of the parameter estimates obtained from GA is comparable to that of NLS and the forecasting performance of the GA estimates is not only better than (or at least as good as) that of NLS estimates but also better than that of time varying estimates. Keywords: Time invariant parameters.

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Monday, 11:25 - 12:25 --- Room: Mérida I

CONTRIBUTED SESSION: MODELING BUSINESS & ECONOMIC CYCLES I

Chair: Christian Dreger

GROWTH AND BUSINESS CYCLES FOR THE SWEDISH ECONOMY 1963 – 1999 Bharat Barot* National Institute of Economic Research (NIER) bharat.barot@konj.se

This paper consists of two parts. In the first part we carry out a traditional growth accounting exercise for the private business sectors of the Swedish economy. We search for structural breaks during the sample period, using Chow tests, using a dynamic specification of Total Factor Productivity (TFP) growth rates. Granger-causality tests are carried out for the nine sub-sectors of the private business sectors of the Swedish economy. We combine the growth rates of value added and hours worked and calculate labour productivity for the period 1960-1999. In order to facilitate comparisons we compare the results of this study with Swedish and international studies. To a large extent we are able to replicate the Swedish results. The slow down in TFP growth rates in the 1970s can be identified with the first and the second oil shocks in 1973 and 1979. The other structural breaks occurred in the early 1990s and could possibly be identified with the Tax Reform of the Century in 1991 and the severest of recession in the Swedish economy. The Granger-causality test indicate that growth rates in investment Granger cause growth rates in TFP for agriculture and financial institutions, real estate and other business, while TFP growth rates in mining and quarrying, and manufacturing Granger cause growth rates in investment. The second part of the paper I Hodrick-Prescott filter the data, and calculate cross correlations of detrended output, hours, investment and TFP at different leads and lags. The results indicate that investment leads TFP for agriculture, hunting, forestry and fishing, electricity gas and water, and for education, health and social work and community social and personal services. Investment lags TFP for the mining and quarrying, manufacturing industry, and for financial institutions and insurance companies, real estate renting and business service companies. Hours worked lead the TFP cycle for mining and quarrying, manufacturing and wholesale/retail trade. The decomposition of TFP into trend and cyclical component historical dates the Swedish business cycle. Standard deviations of the cyclical components of value added, hours worked, TFP, and gross investment reveals that the most volatile variables are gross investment, followed by TFP, GDP and hours worked. The contribution of this part of the paper lies in the disaggregated data set containing annual information for the period 1963-1999, and in the application of several analytical tools to the growth accounting exercise results. In addition such an extensive growth accounting exercise has not been carried out for the private business sectors of the Swedish economy. The data set used in this study can be used for replication purposes.

Keywords: growth accounting, labour productivity, total factor productivity, growth dynamics, Granger- causality, recursive Chow tests, cross correlations, Hodrick-Prescott filtering, leads and lags, new economy.

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IDENTIFYING BUSINESS CYCLES USING MARKOV SWITCHING MODELS Penelope A. Smith Melbourne Institute The University of Melbourne pasmit@unimelb.edu.au Peter M. Summers*

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Recent work by Hamilton, Waggoner and Zha (2002) has demonstrated the importance of identification and nomalization in econometric models. In this paper, we use the popular class of two-state Markov switching models to illustrate the consequences of alternative normalization schemes for empirical analysis of business cycles. A defining feature of (classical) recessions is that economic activity declines on average. Somewhat surprisingly however, this restriction has not been imposed in most published work using Markov switching models. We demonstrate that this matters: inferences from Markov switching models can be dramatically affected by whether or not average growth in the "low state" is required to be negative. We also briefly discuss the implications of normalization for the forecasting performance of these models. Although such a restriction may not always be appropriate in all applications, it is crucial if one wants to draw conclusions about "recessions" based on the estimated model parameters. **Keywords:** business cycles, normalization, regime switching,

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THE INDIVIDUAL AND COMBINED FORECASTING PERFORMANCE OF LEADING INDICATORS FOR THE GERMAN BUSINESS CYCLE

Christian Dreger* Halle Institute for Economic Research (IWH), Kleine Märkerstraße 8, D-06108 Halle, cdr@iwh-halle.de Christian Schumacher Hamburg Institute of International Economics (HWWA), Neuer Jungfernstieg 21, D-20347 Hamburg, schumacher@hwwa.de

In this paper we investigate the forecasting performance of several popular leading indicators for the German business cycle. As examples of survey based indicators, the Ifo business climate index and the ZEW indicator of economic sentiment are considered. In addition, the composite leading indicators of the Handelsblatt, the Frankfurter Allgemeine Zeitung and the Commerzbank are included in the exercise. The analysis points to a significant relationship to the business cycle within the sample period, as measured by the direction of causality. On the other hand, out-of sample forecasts fail to outperform the autoregressive benchmark at any forecasting horizon even if perfect foresight of the indicators is assumed. The result may be caused by structural breaks in the out-of sample period. Unforeseeable breaks can account for high forecast errors, thus violating the indicator approach. However, combinations of forecasts are constructed using different methods of aggregation. Although the combined forecasts work better than the single alternatives, the gains are not overwhelming and restricted to the perfect foresight case. Overall, the ability of popular leading indicators to forecast the German business cycle seems to be quite limited.

Keywords: Leading Indicators, Combined forecasts

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Monday, 11:25 – 12:25 --- Room: Santa Lucía

CONTRIBUTED SESSION: LONG TERM FORECASTING

Chair: J. Thomas Yokum

LONG-TERM FORECASTS OF INCOME Dennis A. Ahlburg* Carlson School of Management, University of Minnesota, dahlburg@csom.umn.edu J. Scott Armstrong Wharton School, University of Pennsylvania, armstrong@wharton.upenn.edu

This paper will summarize and critically review alternative approaches that have been used for producing long-term forecasts of income. Among the approaches that will be discussed are econometric models (structural and reduced-form estimation), extrapolation, structured judgment, and rule-based forecasting. The paper will also discuss the major influences on future economic growth and the mechanisms that link these forces to economic growth. We will also discuss the accuracy of past forecasts of income and the extent to which past forecasts have incorporated uncertainty. **Keywords:** Income, Economic Growth, Long-term, Forecasts

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A MEAN-FIELD MULTI-AGENT MODEL FOR TECHNOLOGY FORECASTING: ASSESSMENT OF FORECASTING PERFORMANCE AND COMPARISON WITH ESTABLISHED DIFFUSION MODELS Christos J. Emmanouilides *

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A mean-field model for technology diffusion forecasting is presented. Its forecasting accuracy is formally examined and is compared to the forecasting performance of 18 well known technological diffusion models for a wide range of forecast origins and lead times. About 900 diffusion curve data series on high technology products across many countries are employed for the comparison of the forecasts. Due to the short-to-medium length of many of the series, simulated data generated using the estimated parameters of the diffusion models are employed to increase the power of the long term forecasting comparisons. The results show that on average the proposed mean-field model forecasts better or equally well to the best of the established diffusion models.

Keywords: Technology Diffusion, Forecasting

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FORECASTING THE LONG-TERM VIABILITY OF AN ENTERPRISE: THE CASE OF A MINOR LEAGUE BASEBALL FRANCHISE J. Thomas Yokum*

Virgil J. Powell Professor of American Economic Principles, Angelo State University, tyokum@angelo.edu Juan J. Gonzalez University of Texas at San Antonio, San Antonio, Texas 78207, jgonzalez@utsa.edu

We are interested in forecasting or predicting the long-term viability of a minor league baseball team. The research question is whether a particular minor league team is going to be successful in attracting attendance over an extended period of time? An important forecasting and financial question issue is that if the team is predicted to fail, then exactly how long will it last? A variety of methods are used over multiple periods to evaluate this viability. We first test whether attendance is evolving or stable through unit root tests, a test of market persistence. We then use the Bass model to assess whether the projected product life cycle is turning up or down. Forecasting principles involving diffusion models are implemented from Armstrong (2001). The Gompertz and logistic (Pearl) diffusion curves are then applied to limited historical data of various lengths in order to make forecasts of a breakeven point. Market saturation is not estimated, but set at the stadium capacity. Finally, analogies are used to assess whether there is long-term potential. Logistic regression supplements the analogy forecasts. The results of the diffusion curves and analogies predict a decline in the minor league team's ability to capture attendance. **Keywords**: Bass model.

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Monday, 13:45 – 14:45 --- Room: Yucatán III

CONTRIBUTED SESSION: NEURAL NETWORKS II

Chair: Lilian M. de Menezes

AN IMPROVED NEURAL NETWORK FOR ELECTRICITY LOAD FORECASTING

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Load forecasting has been a central and integral process in the planning and operation of electric utilities. One of the main concern of load forecastings is the accuracy and robustness of the forecasting model. Both have major influences on security and efficiency in generating, transmitting and distribution of electric power supply. For the past decades, intelligent methods especially Artificial Neural Network (ANN), have been applied extensively and successfully in many utilities around the world. ANN provides better alternatives to traditional forecasting methods due to it's ability in estimating nonlinear models and capturing complex interactions among the input variables in a system, without the need to specify a precise functional form. The neural networks approach to load forecasting in this paper uses the MLP (multi layer perceptron) feed forward network with back propagation training algorithm. The backpropagation model is a supervised learning algorithm using feedforward networks which make use of target values. Backpropagation model is basically a gradient descent method and its objective is to minimize the mean squared error between the target values and the network outputs. The operations of mean square error function are limited by the failure of training to converge. Occasionally, such failure can be attributed to a poor starting point and the solution is merely to restart the training. More often, training finds a comfortable local minimum and refuses to move beyond it, and can cause instability of the internal structure of the network. Therefore, in this study, we consider a sigmoid

function of $\frac{1}{1+e^{-\beta x}}$ as an activation function in the derivation of the proposed method for the backpropagation

model, where β is a constant parameter with proposed error function of $\rho_k = \frac{E_k^2}{2a_k(1-a_k^2)}$. Mathematically, an

improved error function converges faster compared to the mean square error function and this indirectly would generate less epoch size compared to the mean square error function.

Keywords: Load Forecasting, Artificial Neural Networks, Backpropagation Learning, Mean Squared Error, Improved Error

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GOLD PRICE PREDICTION USING DECISION TREE AND SUPPORT VECTOR REGRESSION Pedrudee Ongsritrakul * University, G4464008@ku.ac.th Nuanwan Soonthornphisaj Kasetsart University, FSCINWS@ku.ac.th

Recently, Support Vector Regression (SVR) has been proposed to resolve the time series prediction and regression problems. In this paper, we demonstrate the use of SVR techniques for prediction the cost of gold price by using factors that have effect of gold to estimate its price, The regression comes from forecasted indexes of each factors and we have applying a decision tree algorithm for feature selection tasks. We compared our approach to neural networks and linear regression and found that our approach obtains better performance and our experimental results show that the combination of the decision tree and SVR leads to a better performance.

Keywords: Support Vector Regression, Decision Tree, Gold Price, Neural Networks, Linear Regression.

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PREDICTION INTERVALS FOR POLYNOMIAL NEURAL NETWORK FORECASTS Nikolay Nikolaev Department of Computing Science, Goldsmiths College, London, n.nikolaev@gold.ac.uk Lilian M. de Menezes*

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Recent literature has shown encouraging results in using genetically programmed polynomial neural network models for forecasting. Nevertheless, there are outstanding research issues, among which the formulation of interval forecasts. In this paper, we address the problem of assessing the uncertainty in neural network forecasting models and develop confidence and prediction intervals for the GP polynomial neural network forecasts. **Keywords**: interval forecasts, polynomial neural networks, error variance learning.

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Monday, 13:45 – 14:45 --- Room: Yucatán IV

CONTRIBUTED SESSION: JUDGEMENTAL FORECASTING I

Chair: Michael Lawrence

DO PEOPLE UNDERSTAND THE QUALITY OF THEIR OWN JUDGEMENTAL FORECASTS?

Marcus O'Connor * School of Business, University of Sydney, m.oconnor@usyd.edu.au William Remus College of Business Administration, University of Hawaii, remus@hawaii.edu Kai Lim City University of Hong Kong, iskailim@is.cityu.edu.hk

Given that people are prone to rely on their own judgement rather than statistical models, this study examined the extent to which people are introspective about the quality of their own judgements. It used a laboratory experiment where people were required to combine the forecasts of three different people who were part of the forecasting process – forecasts from the planning department, the marketing department and the sales department. The three departments produced forecasts of varying accuracy. The participants of the experiment were randomly assigned to three different conditions. The first was where only outcome feedback was provided – i.e. after making a forecast the true value was displayed and the next round of the experiment was conducted. In the second condition, participants were provided with cognitive feedback at the end of 20 periods and 40 periods. Cognitive feedback provides people with individualised statistical analysis of what factors people seem to be focusing on, in addition to the regular feedback. For the third condition, people were provided with cognitive feedback as well as a computer generated bootstrap forecast. Results indicate that the nature of the feedback made a difference to the accuracy of the judgemental forecasts, with cognitive feedback leading to the greatest improvement. However, there seemed to be little difference in the way people viewed the quality of their own forecasts. There was even a tendency for people to view themselves as good (bad) forecasters despite their forecasts being relatively bad (good).It also had little effect on the confidence placed in the forecasting process.

Keywords: Judgemental forecasting

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JUDGMENTAL ADJUSTMENTS OF STATISTICAL VS. EXPERT FORECASTS Dilek Önkal-Atay*

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This research focuses on judgmental adjustments of external forecasts when the presented predictions are portrayed as originating from statistical techniques versus experts. Using point forecasts, 70% prediction intervals and 95% prediction intervals, we investigate the effects of such source-framing with and without the elicitation of initial predictions from participants. In particular, 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) on real-time stock price series. Participants are then requested to report a forecast based on their judgmental adjustments of the external forecasts in light of the time-series information. We discuss the implications of our findings for forecasting support systems.

Keywords: Judgment, Adjustment, Forecasting, Format

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ARE JUDGEMENTAL FORECASTS IMPACTED BY THE SOURCE OF THE ADVICE?

Michael Lawrence* School of Information Systems, Technology and Management, University of New South Wales, M.Lawrence@unsw.edu.au Melissa Warren

School of Information Systems, Technology and Management, University of New South Wales

This paper presents the results of a study carried out to investigate the influence in decision making of two attributed information sources of forecast advice - a human expert and a computer model. The effect of factors such as trust, confidence, expertise and risk will also be examined with respect to their affect on advice acceptance in the decision making process. Subjects were asked to play the role of a Information Systems Manager who has to make decisions on resourcing a number of Information Systems projects. Six projects were presented to each subject by a brief description oulining the general character of the project, its level of novelty of technology and the riskiness of the project. In addition for each project the subjects, students in a class on Information Systems Project Control, were given two estimates of the project cost - one sourced from "an Expert in project cost estimation" and one sourced from "a computer system based on a substantial data base of project costs and which has has been demonstrated to reliably estimate cost". Each estimate was also accompanied by an advisor confidence rating. We anticipated that the computer system would be trusted more for routine systems while the human expert would be trusted more for novel systems. In addition we expected that there would be a bias to trusting the human expert. The results showed no systematic bias in favour of the human or computer but a very strong bias in favour of the higher estimate, as might be anticipated in a field with a long history of too low estimates. The results also showed that estimates with a higher confidence rating were favoured regardless of the source of advice. Keywords: Forecasting, advice, computer, human, judgement.

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Monday, 13:45 – 14:45 --- Room: Mérida II & III

ORGANIZED SESSION: BAYESIAN FORECASTING

Organizer and Chair: Eduardo Gutiérrez-Peña

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FORECASTING WITH LATENT SPACE-TIME MODELS

Dani Gamerman*

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This talk describes forecasting techniques for time series in the presence of spatial interactions, occuring for example when dealing with real state or environmetric data. The modelling approach is based on the use of latent variables describing the space and time interactions. Spatial interactions are described via Gaussian processes and temporal interactions are described via dynamic models. Spatial interpolation and isotopic structures are considered. Application to simulated and real data are presented.

Keywords: Bayesian; Geostatistics; Markov chain Monte Carlo; predictive distribution; system evolution.

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A BAYESIAN MODEL FOR RE-INSURANCE DATA

Alberto Contreras-Cristán* I.I.M.A.S.-U.N.A.M. alberto@sigma.iimas.unam.mx

In recent years, the use of extreme value distributions to model actuarial data has increased. In particular a modern approach in which, conditionally on a Poisson count, excesses of claim values over a threshold are modelled using the generalized Pareto distribution (Poisson-GPD models) is discussed in Smith (2000). Examples of studies with models in this class and from a Bayesian perspective can be found in Smith and Goodman (2000), and Coles (2001). Because of the lack of conjugate families for some parameterizations in the Poisson-GPD models, numerical algorithms such as the Metropolis-Hastings MCMC are required to generate posterior samples. In this work we model a simulated data set inspired on a real framework. This corresponds to re-insurance claims where there are no exact dates of events. The information available is the value of the claims, the year of occurrence and an indicator of whether the claim value is censored or not. Assuming the Poisson-GPD model and specific prior distributions for annual parameters in localization and scale, posterior samples are obtained. These can be used in turn to produce samples of the predictive distribution for the data

Keywords: Predictive distribution, Poisson-GPD models, Bayesian Inference.

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BAYESIAN NONPARAMETRIC FORECASTING FOR MIXED POISSON PROCESSES Eduardo Gutiérrez-Peña* Department of Probability and Statistics, National University of Mexico,eduardo@sigma.iimas.unam.mx Luis Enrique Nieto Barajas Department of Statistics, ITAM, Inieto@itam.mx

The Poisson process is often found to be too restrictive to be useful in certain applications. Several generalizations have been proposed in the literature, including non-homogeneous, mixed, and doubly-stochastic Poisson processes. In this talk we discuss a Bayesian nonparametric approach to the analysis of non-homogeneous mixed Poisson processes, where the mean function is modelled *a priori* as a process with independent increments. Posterior and predictive inferences are carried out via a Gibbs sampling scheme. This approach is illustrated with insurance data. **Keywords:** Bayesian predictive distribution, Gamma process, Negative Binomial process

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Monday, 13:45 – 14:45 --- Room: Valladolid

CONTRIBUTED SESSION: FORECASTING INFLATION I

Chair: Renuka Mahadevan

CAN DEMOGRAPHY IMPROVE INFLATION FORECASTS? THE CASE OF SWEDEN Mattias Bruér*

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Sweden, like many other developed economies, will experience a very large share of the population past their working years in the years to come. This transition into a more dependent population will have consequences for many macroeconomic variables; among them inflation. The demographic structure is particularly well suited for forecasting purposes. In contrast to other macroeconomic variables, even at long horizons the forecasting errors will be small when extrapolating the series. In this paper I show that a model that uses this age structure information not only forecasts well on longer horizons, but also outperforms the alternative models on shorter horizons (i.e. one to two years). Given the strong out-of-sample forecasting performance I conclude that the source of information embedded in the age shares is something that the Riksbank (Bank of Sweden) should consider when conducting monetary policy. Further, this view is definitely strengthened by the in sample results. The results agree with the Phillips-Okun framework assuming that demography affects productivity. The relative age effects are also at large in accordance with what could be expected from life-cycle theory emphasizing that savings and consumption will differ over the course of life. **Keywords:** Inflation forecasting, Demography, Life-cycle hypothesis

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FORECASTING INDUSTRY-LEVEL CPI AND PPI INFLATION: DOES EXCHANGE RATE PASS-THROUGH MATTERS? Dimitrios D. Thomakos Department of Economics, Florida International University, thomakos@fiu.edu Prasad S. Bhattacharya*

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The new open economy macro literature intensely debates the choice of the appropriate exchange rate regime and its effects on the real economy, including prices and output. Based on the "optimal regime", the variability of the exchange rate, and its effect on import prices, will either affect domestic prices (flexible exchange rates) or not (fixed exchange rate). Therefore, it seems natural to consider whether out-of-sample forecasting improvements can be achieved, when forecasting CPI and PPI inflation, by taking into account possible pass-through effects. In this paper, we examine whether industry-level forecasts of CPI and PPI inflation can be improved when one accounts for such pass-through effects, that is when one accounts for the variability of the exchange rate and import prices. An exchange rate depreciation leading to a higher level of pass-through to import prices implies greater expenditure switching, which should be manifested, possibly with a lag, in both producer and consumer prices. We build a forecasting model for CPI and PPI inflation where the effects of the exchange rate and import prices are taken into account. The model we use is a two or three equation system that accounts for the dynamics of all variables, as well as for their lagged correlations, and includes appropriate restrictions suggested by the theory. We compare the performance of this model with a variety of unrestricted univariate and multivariate time series models, as well as with a model that, in addition, includes standard control variables for inflation, like interest rates and unemployment. Our results indicate that improvements on the forecast accuracy can be effected when one takes into account the possible pass-through effects of exchange rates and import prices on CPI and PPI inflation.

Keywords: Forecasting, Pass-through effects, Exchange rate regime, Expenditure-switching, Inflation.

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IS THERE A CASE FOR LOW INFLATION INDUCED PRODUCTIVITY GROWTH IN SELECTED ASIAN ECONOMIES? Renuka Mahadevan* School of Economics, The University of Queensland, r.mahadevan@economics.uq.edu.au

John Asafu-Adjaye School of Economics, The University of Queensland, j.asafu-adjaye@economics.uq.edu.au

A belief in the existence of a negative relationship between inflation and productivity growth has persuaded some countries to adopt a zero or low inflation target. This paper examines the evidence on this relationship for nine Asian economies using cointegration analysis and an error correction model. The inflation-productivity growth relationship is found to be non-uniform as the evidence of unidirectional, bi-directional, and no causality between the two variables is varied and significant for some countries and insignificant for others. An attempt is also made to explain the inflation-productivity nexus for these countries to address the underlying implications of the findings for anti-inflationary policies such as inflation targeting.

Keywords: Productivity Growth, Inflation Targeting, Time-Series Analysis, Error Correction Models.

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Monday, 13:45 - 14:45 --- Room: Mérida I

CONTRIBUTED SESSION: STATISTICAL METHODS I

Chair: Guy Mélard

FORECASTING WITH SYMBOLIC DATA. APPLICATIONS TO BOXPLOTS

Carlos Maté*

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Symbolic data are more complex than classical data, which provide a single value, in the sense they contain internal variation and are structured. They arise from many sources and with the intention of capturing key information. For example, summarizing huge amounts of data by frequency distributions, intervals or some other underlying concept like a boxplot. Forecasting with symbolic data is specially useful when one magnitude is measured in continuous time but the practical interest lies in the structure of the same in discrete time, or the concern is in the variation of a magnitude through one unit of time (e.g., days) and the information is collected in other lower unit of time (e.g., hours), or the forecasting variable is measured in a group of individuals (e.g. country). In all of these cases it would be better (more realistic) to consider a symbolic variable, which contains variation (e.g. interval, distribution, etc.), than a classical one, which shows only one value (e.g. the mean of the distribution). Moreover, symbolic data are very adequate to model prediction in qualitative frameworks. The theory of symbolic data analysis is an emerging area where some important advances have been reached in the last years. However, very few things are known about how handling and analyzing these data in a temporal setting. This paper proposes some general ideas about forecasting with symbolic data focusing on a special class of this kind of data, boxplots. Finally, one practical context is considered in order to assess the usefulness of such approach.

Keywords: Forecasting Methodology, Forecast Evaluation, Time Series, Quantile Forecasting, Boxplot.

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ON THE DISTRIBUTION OF STATISTICS RELATED TO FIRST-ORDER AUTOREGRESSIVE MODELS Serge Provost*

Department of Statistical & Actuarial Sciences, The University of Western Ontario, provost@fisher.stats.uwo.ca Deepak Sanjel

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We propose symbolic and recursive methodologies which allow for the efficient evaluation of high-order moments of statistics related to AR(1) processes, including the Durbin-Watson statistic as well as several estimators of the first-order autoregressive parameter. More specifically, the Yule-Walker, Burg and least-squares estimators are considered. The upper and lower bounds of the support of their distributions are determined, and an approach is suggested for correcting their bias. All these statistics can be expressed as ratios of quadratic forms in normal random variables. It will be shown that their distributions can be approximated with great accuracy from their moments in terms of finite sums involving orthogonal polynomials. Several illustrative examples will be presented, and other relevant applications of the results will be pointed out as well.

Keywords: Density approximation, Durbin-Watson statistic, AR(1) process, moments, symbolic calculations.

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SOFTWARE FOR A TIME SERIES ANALYSIS COURSE Guy Mélard*

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This paper is the line of Cohen et al. (2002, http://homepages.ulb.ac.be/~gmelard/Hawaii02.pdf) where a distance course on time series analysis fulfilling the needs of the National Bank of Belgium (NBB) was described. The course for NBB is oriented towards applications and include case studies. A constraint of NBB was to use available software, among them Microsoft Office, or no-cost software. Another requirement was that the course should cover the most recent seasonal adjustment methods including X-12-ARIMA and TRAMO/SEATS. In another paper, we have justified the use of a spreadsheet program, more particularly Microsoft Excel. However, there are several limitations with Excel for the introduction of ARIMA models, and fitting their parameters as well as those of regression with autocorrelated errors. Except illustrating partly the original Census X-11 method, handling a simple signal plus noise decomposition from an ARIMA(0,1,1) process, using spectral estimation by the autoregressive method, Excel cannot be used for seasonal adjustment either. Here we discuss the usefulness of other software solutions. We have used Time Series Expert (see Mélard and Pasteels, 2000) and Demetra, which are both free for that purpose. Generation of artificial time series from ARIMA models and estimation of the parameters of ARIMA models on real series were done using Time Series Expert (TSE). More generally, we have used TSE for illustrations on real data for all the chapters of the course because the treatment is then closer to what can be achieved with a statistical package. For the last chapters on regression with autocorrelated errors and seasonal adjustment with X-12-ARIMA and TRAMO/SEATS, we have used Demetra, which is an interface developed by Eurostat, the statistical office of the European Commission above the genuine programs.

Keywords: spreadsheet, distance course, forecasting time series analysis.

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Monday, 13:45 – 14:45 --- Room: Santa Lucía

CONTRIBUTED SESSION: DEMOGRAPHIC FORECASTING

Chair: Rob Hyndman

ROBUST DEMOGRAPHIC FORECASTING

Krishna Gayen Napier University, k.gayen@napier,ac,uk Robert Raeside* Napier University, r.raeside@napier.ac.uk

The predominant method of forecasting in demography is the component method, which is an inherently bottom up methodology. This method is reliant on making predictions of population at various ages by using accounting procedures based upon input predictions of the vital rates of fertility and mortality and making allowances for migration. In uncertain conditions, such as in the developing world, these methods have proved far from accurate. In this paper a top down methodology is presented in which an attempt is made to limit the potential error in forecasts. The method is based on predicting total population, then proportioning into genders, and then by use of rational life table projections obtaining forecasts of the number of births and the population in different age ranges for each sex. The forecasting performance of this methodology is evaluated and it is shown that the approach is worthy of further consideration and will be particularly helpful in the developing world. **Keywords**: Top down methodology.

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A FUNCTIONAL DATA APPROACH TO MORTALITY FORECASTING

Rob J Hyndman

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We propose a functional data approach to mortality forecasting. The key features of our approach are (1) it treats mortality curves as continuous functions rather than series of discrete observations; (2) it uses nonparametric smoothing to reduce noise in the observations; (3) it uses monotonicity constraints to avoid undesirable estimates for older ages; (4) it uses a principal components decomposition to obtain an optimal set of basis functions and to avoid correlations in the coefficients; and (5) it uses a state space approach to exponential smoothing to provide automatic forecasts of coefficients. We apply our methodology to US mortality data over the last 100 years and show that it out-performs all existing methods. In particular, it leads to some surprising predictions about where mortality will improve (and not improve) in the next few decades.

Keywords: Demography, exponential smoothing, functional data, mortality, nonparametric regression, principal components, regression splines.

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FORECASTING FUNCTIONAL DATA

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For each time period t we observe a continuous curve $f_t(x)$ over a range of values of x. For example, these curves may be observed daily and represent the interest rate for different investment periods (here x is the term of the investment and t is the day the investment was made). Another application is to mortality where t is the year of observation, x is age and $f_t(x)$ is the death rate observed in year t for age x. A third application is to weather data where $f_t(x)$ is the temperature on day x in year t. We assume that $f_t(x)$ is a smooth curve in x that is slowly changing over time t. We describe a new method for forecasting such functional data using a mixture of nonparametric smoothing and principal components analysis. Our approach yields an optimal decomposition of $f_t(x)$ into orthogonal components and allows simple univariate forecasting to be used for each component. We will demonstrate the methodology using real data. **Keywords**: Functional data, nonparametric smoothing, principal components.

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Monday, 15:00 – 16:00 --- Room: Yucatán III

ORGANIZED SESSION: FORECASTING ASPECTS IN VOLATILE TIME SERIES AND LONGITUDINAL DATA ANALYSIS

Organizer and Chair: Brajendra Sutradhar

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VOLATILITY FORECASTING WITH GARCH AND THE GENERALIZED SKEWED T DISTRIBUTION Larry Bauer*

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The Generalized Autoregressive Conditional Heteroskedasticity (GARCH) family of models has found great popularity in the analysis of financial time series. While GARCH models have frequently been found to provide superior insample fit, they have been less successful at out-of-sample volatility forecasting. A potential source of this poor out-ofsample performance is that GARCH models are commonly constructed under the assumption of conditional normality. This is problematic as, even conditionally, financial time series are generally found to be leptokurtic and skewed. A second issue is that the proliferation of alternative and sometimes partially overlapping specifications for GARCH models makes it difficult to determine which particular model is appropriate in a given modeling or forecasting situation. This paper uses the skewed generalized T distribution of Thedossiou (1998) to address these issues by constructing and testing out-of-sample one-period ahead daily and monthly forecasts of volatility for a number of daily financial series. In particular, the volatility forecasting performance of a general GARCH model under the assumption of non-normally distributed errors is assessed for several stock indices, foreign exchange rates, and interest rates. The generalized skewed T distribution is an attractive choice for an alternative distributional assumption in that it allows for asymmetric response in the GARCH model and nests, among others, the student's t and normal distributions. **Keywords:** Volatility Forecasting, GARCH, t-distribution.

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GAMMA STOCHASTIC VOLATILITY MODELS

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This paper examines stochastic volatility processes when the volatilities are generated by exponential and gamma autoregressive models. The parameter estimators are obtained by the method of moments and are shown to be consistent and asymptotically normal. The simulation results indicate that the estimators behave well. An empirical example using stock index return data suggests that gamma stochastic volatility models capture the leptokurtic distribution of stock returns.

Keywords: Stochastic volatility, Moment estimation.

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FORECASTING LONGITUDINAL COUNT DATA USING LONGITUDINAL MIXED MODELS Brajendra C. Sutradhar* Memorial University of Newfoundland, bsutradh@math.mun.ca V. Jowaheer University of Mauritius, Mauritius

Unlike the forecasting for continuous data, the forecasting for discrete data, for example, for time series of counts, is not adequately addressed in the literature. In this talk, similar to the Gaussian time series process, we demonstrate how to develop a forecasting function, based on a suitable observations driven correlated model for count data. The performance of the forecasting function is examined through a simulation study. Forecasting functions are also developed for longitudinal count data, and their performances are examined both theoretically and empirically. Results are illustrated by analyzing a real life longitudinal data for patents and R & D relationship.

Keywords: Time series of counts, Observations driven process, Longitudinal counts, One step ahead forecasting, Forecasting error.

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Monday, 15:00 – 16:00 --- Room: Yucatán IV

CONTRIBUTED SESSION: TREND MODELING

Chair: Natasha Atanackov

A NEW TREND-CYCLE PREDICTOR FOR CURRENT ECONOMIC ANALYSIS

Estela Bee Dagum Department of Statistics, University of Bologna, Italy, beedagum@stat.unibo.it Olivier Darné* LAMETA, University of Montpellier, France,darne@lameta.univ-montp1.fr

We propose a modification to the Dagum (1996) non linear non parametric method, to improve on the size of the revisions to the most recent trend-cycle estimate. We perform a comparative analysis of the new estimator with that of Dagum (1996) and others incorporated in seasonal adjustment methods, namely, X11-ARIMA, RegARIMA, TRAMO-SEATS and STAMP. They are all applied to different monthly data sets with various level of volatility: (i) real seasonal time series, (ii) long seasonally adjusted series, and (iii) non seasonal simulated series. The performance of the trend-cycle estimators discussed is evaluated on the basis of four major criteria for current economic analysis: the identification of true turning points, time delay of detection, number of unwanted ripples (false turning points) produced, and the size of revisions to the concurrent trend-cycle estimate. The results show that the proposed modification to the Dagum method produces smaller revisions while maintaining its good properties of true turning point detection, short-time delay and small number of unwanted ripples in the final curve. Furthermore, it is shown that the non parametric trend-cycle predictors perform systematically better than the parametric ones available in RegARIMA, TRAMO-SEATS and STAMP.

Keywords: Dagum non linear trend-cycle predictor, parametric trend-cycle predictors, RegARIMA, TRAMO-SEATS, STAMP, Revision size, Time-delay of true turning point detection, False turning points.

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A NEW CRITERION TO SELECT THE SMOOTHING PARAMETER OF THE HODRICK AND PRESCOTT FILTERING PROCEDURE

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The Hodrick and Prescott filtering procedure plays a central role in the analysis of macroeconomic time series. Its objective is to extract the permanent component of a given series. To apply the filter the analyst has to provide a parameter value that controls the trade off between fit and smoothness of the permanent component. The cyclical component of the series can then be obtained as the difference between the original and the permanent series. It is the cyclical component the main product when studying the relationships among different macroeconomic variables. Hodrick and Prescott decided to use the value 1600 for the smoothing constant, based on their empirical investigation. In the present paper we argue against the use of this value as a universal constant. Thus we provide a new view of the permanent component. Several simulations were carried out to validate our findings. The data employed by Hodrick and Prescott in their seminal paper were also used here to compare our proposal with theirs. Finally, an empirical application with Mexican data is also performed to appreciate the kind of results that can be obtained in practice. **Keywords**: Economic time series, relative precision, smoothing parameter, unobserved components.

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A DECISION TREE FOR THE SELECTION OF A TREND MODEL Natasha Atanackov* Buckinghamshire Business School, Natasha.Atanackov@bcuc.ac.uk John Boylan,

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A decision tree for selecting appropriate univariate non-seasonal extrapolative forecasting methods will be proposed and assessed in this paper. The analysis is based on an examination of some appropriate mathematical models that underpin the relevant forecasting methods. Four widely used mathematical models and their optimal forecasting methods are included in the decision tree. The models are: stationary mean model, steady state model, damped trend model and linear growth model. The first two models are suitable for non-trended time series and the others for trended time series. In order to choose the appropriate model for a given time series, three diagnostics are used in the proposed decision tree. To distinguish between the trended time series and series without trend, a new modified version of Gardner and McKenzie's (1988) Variance procedure was applied. Subsequently, if the series was classified as trended then a new extension of Harrison's (1967) Serial Variation Curves was applied in order to decide between the recent trend and damped trend model. On the other hand, if the time series is classified as non-trended then Lagged First Differences are applied in order to distinguish between the time series that exhibit a stationary mean and those which have mean values fluctuating over time. A simulation experiment has been conducted to examine accuracy gains that may be achievable using the proposed procedure for model selection. The results are presented and the application of the new procedure to real world data is discussed.

Keywords: Mathematical models, forecasting methods, Variance procedure, Serial Variation Curves, Lagged First Differences

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Monday, 15:00 - 16:00 --- Room: Mérida II & III

CONTRIBUTED SESSION: MACROECONOMIC FORECASTING II

Chair: Adusei Jumah

A TIME SERIES DISAGGREGATED MODEL TO FORECAST GDP IN THE EURO-ZONE.

Román Mínguez Univ. San Pablo-CEU (Madrid, Spain), minsal@ceu.es Antoni Espasa* Univ. Carlos III (Madrid, Spain), espasa@est-econ.uc3m.es

The aim of this paper is to present a simple approach to forecast GDP in the Euro-zone. The procedure is based on the methodology developed in the Bulletin of EU and US Inflation and Macroeconomic Analysis, Universidad Carlos III, Madrid. This methodology relies on disaggregation, specific and general leading indicators and non-linear structures when required.In this case the procedure considers two alternative ways of breaking down GDP in a vector of n components: (a) by items of the final demand and (b) by production sectors. In each case some cointegration relationships are estimated but they do not have a clear theoretical basis and do not help to improve forecasting accuracy. In view of these results, forecasting models are constructed as single-equation dynamic models with leading indicators and expected GDP value. For each trace forecast at a base point t these expectations are computed in a recursive way. Thus an ARIMA model provides the expected GDP value for the next period, which is used to forecast GDP components, from which a final GDP forecast at (t+1) is constructed. This forecast is taken as a new observation in the ARIMA model for GDP and the entire process is repeated until the end of the forecast horizon. The above procedure provides two GDP forecasts, one using information on demand components and another using production data. Both these forecasts are then combined to provide the definitive GDP forecast. The component forecasts in each vector, demand and production, are adjusted to obtain the definitive GDP forecast by correcting the forecast for the most volatile component in each disaggregation, changes in inventories and taxes. Keywords: GDP, expectations, leading indicators, forecasting, euro-zone.

Rey words: OD1, expectations, reading indicators, forecasting, earo zone.

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MODELLING U.S. MONETARY POLICY: A FIG'S WORTH OF DIFFERENCE Anirvan Banerji*

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The Taylor rule, the best-known explicit rule for conducting monetary policy, posits a simple relationship between output, inflation and a central bank's interest rate decisions. It has been shown in many earlier papers to have accurately tracked the movements in the Federal Funds rate controlled by the U.S. Federal Reserve from the beginning of Alan Greenspan's tenure as Federal Reserve chairman in 1987 at least through the mid-1990s. In the late 1990s, however, the U.S. economy entered a period of robust non-inflationary growth, and the basic Taylor rule became a poor descriptor of monetary policy. A key question we ask in this paper is whether an alternative framework might not better capture the workings of monetary policy during the Greenspan years, including the late 1990s. According to the Taylor rule, the gap between the economy's actual output and its potential output, also known as the output gap, is used as a measure of underlying inflationary pressures, and, in conjunction with inflation, can be used to guide interest rate decisions. In this paper, we compare the output gap with an alternative measure of underlying inflationary pressures, the Future Inflation Gauge (FIG), which is a composite index of leading inflation indicators devised by Greenspan's late teacher, Geoffrey H. Moore. We find that the FIG works better than the output gap in describing monetary policy during the Greenspan years from 1987 through 2001. In particular, a cointegration analysis of the FIG, the Federal Funds rate and inflation supports the conclusion that the three variables are cointegrated. However, the output gap, the Federal Funds rate and inflation are not cointegrated, which is consistent with the breakdown of the Taylor rule in the late 1990s. Thus, the FIG appears to be superior to the Taylor rule as a descriptor of U.S. monetary policy.

Keywords: Monetary Policy, Inflation, Interest Rates, Leading Indicators, Output Gap.

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MODELLING NATIONAL ACCOUNTS SUB-AGGREGATES: AN APPLICATION OF NON-LINEAR ERROR CORRECTION

Adusei Jumah *

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Many macroeconometric models depict situations where the shares of the major demand aggregates in output are stable over time. The joint dynamic behaviour of the considered demand aggregate and output may thus be approximated by a cointegrated vector autoregression. However, the shares of many demand sub-aggregates in output are rather mobile and changing over time. In order to simultaneously capture the flexibility of the shares of the sub-aggregates and the long-run constancy of the share of the total aggregate, we consider trivariate systems of two macroeconomic sub-aggregates and output with error-correction terms that are non-linear functions of the original variables. The merits of the models are evaluated by means of several forecasting experiments.

Keywords: Macroeconomic accounts, Great ratios, Non-linear error correction, Forecasting.

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Monday, 15:00 – 16:00 --- Room: Valladolid

CONTRIBUTED SESSION: M3 COMPETITION

Chair: Michèle Hibon

USING MISSPECIFICATION TESTS ON WITHIN-SAMPLE MODELS AND CONSIDERING THE TRADE-OFF BETWEEN LEVEL OF SIGNIFICANCE AND POWER TO PROMOTE WELL-CALIBRATED, POST-SAMPLE PREDICTION INTERVALS

Bernard J. Morzuch*

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We applied the naïve no-change method to the 3003 series in the M3-Competition. This method is optimal for the random walk model. Based on within-sample misspecification tests, a series was placed in one of two groups: either it passed our entire battery of four tests or it failed one or more tests. Distributions of ex post forecasts from groups that passed all tests were better calibrated than distributions from the other groups. To improve the delineation between the two groups, we developed overall significance levels to reflect the joint nature of the tests rather than treat the tests independently. We analyze the change in calibration of the distributions as a result of paying attention to the joint nature of the tests. In addition, recognizing that increasing the level of significance increases the power of the test, we analyze the change in calibration of the trade-off between significance level. Currently, we are developing simulation exercises that attempt to look at the trade-off between significance level and power and their impact on the calibration of prediction intervals.

Keywords: Prediction Intervals, Calibration, Significance, Power

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DEVELOPING MODELS FOR EXTRAPOLATIVE METHOD SELECTION AND THE BENEFITS OF CHOICE? Robert Fildes*, Lancaster University Management School, UK, R.Fildes@Lancaster.ac.uk Michele Hibon, INSEAD, France, Michele.hibon@insead.edu Wlodek Tych, Dept Environmental Science, Lancaster University, UK, W.Tych@Lancaster.ac.uk

The M3 competition has shown that various standard univariate forecasting methods such as damped trend are hard to beat when the data series are heterogeneous. Further progress on forecast improvement can only be achieved through either a new and better method or an approach that effectively selects the method (from a range of alternatives) that best suits an individual series, an approach known as 'individual selection'. It has already been established that the potential exists ex post for improvement. This research examines a sub-set of monthly data from the M3 competition using multiple time origins to examine different ex ante approaches to individual selection to establish whether gains can be made from selection. Various summary statistics for the data characteristics are proposed and expanded to include past performance. Preliminary results show that past performance is the key predictor of current performance. However two key questions must be answered – do other characteristics improve the proposed predictive model and are the results any better than the naïve selection of damped trend.

Keywords: Forecasting competitions, Method choice,

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M3- COMPETITION: ARE THE DIFFERENCES BETWEEN THE FORECASTING METHODS SIGNIFICANT? Michèle Hibon* INSEAD, michele.hibon@insead.edu Herman Stekler Department of Economics, George Washington University, hstekler@gwu.edu

In this paper we test the hypothesis that the errors of all forecasting methods of the M3-competition are not significantly different, using a very simple non-parametric test. The method we used eliminates all discussion of the error measure that is used because the errors are not averaged across all series, but are based on the ranking of the errors, for each series, and each horizon. To evaluate the performance of a particular forecasting method relative to all other methods, we test if it is significantly better than the average. We also test if the percentage of times one method is better than another is significant.

Keywords: M3-competition, Forecasting methods, Forecasting accuracy

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Monday, 15:00 - 16:00 --- Room: Mérida I

CONTRIBUTED SESSION: STATISTICAL METHODS II

Chair: Patrick E McSharry

MODELLING THE EVOLUTION OF INTER-PURCHASE TIMES FOR CONSUMER PACKAGED PRODUCTS Nigel Meade * The Business School, Imperial College London, Exhibition Road, London SW7 2AZ, UK n.meade@imperial.ac.uk Towhidul Islam Department of Consumer Studies, University of Guelph, Ontario, 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. The model is estimated for two products using Australian panel data. The parameters of the inter-purchase time density function stabilised after the second re-purchase for each product. The measure of dependency between inter-purchase times stabilised after one or two cycles.

The model of an individual household's behaviour is aggregated over a population of households to produce a time series of product sales. The effect of model parameters on the properties of the time series is investigated. **Keywords**: Marketing, time series, copula, consumer goods

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PREDICTING THE UNPREDICTABLE. TRIZ AND DISRUPTIVE INNOVATIONS Darrell Mann* Director, CREAX, UK, darrell.mann@creax.com Simon Dewulf CEO, CREAX n.v., Ieper, Belgium, simon.dewulf@creax.com

It often seems that the only sure thing about any form of technology forecast produced by any of the currently known techniques is that they will be wrong. The biggest single cause why they are wrong is that they assume the world to be mappable using linear models. Prevailing logic dictates that non-linearities are fundamentally non-predictable. While this may be true in certain instances (September 11 for example), in the large majority of cases, research on systematic innovation methods has demonstrated that non-linear disruptions can be reliably and accurately predicted. The basis for this – perhaps difficult to believe – claim emerges through a programme of research built from the analysis of over 3 million patents and scientific advances. This research - part of the biggest study of creativity ever conducted - has demonstrated that systems evolve through a number of distinct and predictable stages. Thus far, 35 known trends of evolution have been uncovered. The paper demonstrates how these trends could have been used to predict disruptive technology shifts like the digital camera, ultrasound-based washing machines, and many others, and, more importantly, how leading companies are beginning to use them to systematically identify new disruption opportunities. The uncovered trends offer a very clear picture of the 'what's' of disruptive innovation. Using these trends as the foundation, the paper then proceeds to examine how they can be used in conjunction with business and market trends in order to also predict the 'when's'. In discussing the subject of innovation timing, the paper defines the tension between market pull and technology push as the principle disruption driver. With regard to 'market pull', the paper further demonstrates that even when those market forces are hidden (as was the case with the digital camera), disruptions can still be uncovered in a systematic and reproducible manner. The paper is split into three main sections. The first two cover respectively the what's and when's of disruptive innovation as described above. The third section of the paper describes an emerging paradox related to the uncovered trends of evolution. This paradox shows that the assumptions used in the construction of conventional technology forecasting exercises are the very things providing the triggers for the disruption opportunities. The paper includes a series of real case study examples to demonstrate the validity and likely impact of the disruption prediction capability throughout. Keywords: Technology forecasts.

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PROBABILISTIC FORECASTING OF OBSERVED TIME SERIES USING NON-LINEAR MODELS Patrick E McSharry*

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Time series data is invariably contaminated by measurement errors due to observational uncertainty. Probabilistic forecasts provide a means of accounting for both observational uncertainty and model inadequacy using an ensemble of initial conditions and multiple models. These models can include both linear and non-linear structures. While many time series are believed to have been generated by non-linear processes, practitioners are often reluctant to employ novel non-linear techniques instead of traditional linear methods. This is due to the fact that linear methods are usually well understood, are often simpler to use and have been tried and tested on many data sets. The increasing availability of computing power provides the opportunity for utilising non-linear methods despite their complexity. It is this complexity that can increase predictability, but can also lead to over-fitting problems. The advantages and disadvantages of non-linear models, particularly with regard to their selection, estimation and evaluation, when faced with observational uncertainty, are investigated. The importance of using appropriate statistical methods for non-linear models is discussed, noting that linear mean-squared error criteria are likely to unfairly reject non-linear candidate models. These methods are demonstrated using both synthetic and observed time series data. **Keywords:** forecasting, probabilistic, observational uncertainty, non-linear

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Monday, 15:00 – 16:00 --- Room: Santa Lucía

CONTRIBUTED SESSION: ECONOMETRICS

Chair: John Asafu-Adjaye

THE DYNAMIC EFFECTS OF INTERNAL AND EXTERNAL SHOCKS OVER OCCUPACY FOR THE LARGEST MULTIFAMILY PROPERTY MANAGEMENT COMPANY IN THE U.S

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The purpose of the paper is to stablish some of the variables that affect and drives the dynamics of occupancy for AIMCO, the largest multifamily property management in the U.S. We estimate and unrestricted VAR model containing 36 equations: The first thirty one equations account for internal pressures as: economic occupancy (NRI / TGP), net rental income per unit (NRIU), net operating income per unit (NOIU), bad debt to NRI ratio, bad debt to NOI ratio, bad debt per unit, occupancy, effective Gross Income per unit (EGIU), utilities expenses per unit, contract services expenses per unit, repairs & maintenance expenses per unit, turnover expenses per unit, administrative expenses per unit, marketing expenses per unit, payroll expenses per unit, management & accounting expenses per unit, interest income expenses per unit, taxes expenses per unit, parking income per unit, security deposits per unit, concessions reimbursement per unit, discount residents per unit, resident relations concessions per unit, resident referral concessions per unit, frequency of fires, cost of fires (severity), total gross potential per unit, Saferent cutpoints and, five equations to account for external pressures as: unemployment, AIV stock price, interest rates, inflation and, single and multifamily permits. The econometric consistency permits us to forecast key variables when subject to one period shocks and general shocks over multiple time periods. **Keywords**: economic occupancy, saferent cutpoints

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A TEST FOR UNBIASED EXPECTATIONS BASED ON QUALITATIVE SURVEY DATA Christian M. Dahl*

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This paper develops a unified econometric approach for testing unbiasedness of expectations based on direct observations on expectations obtained from qualitative survey data. An ordered multinomial probability model is employed to link unobserved expectations to observations on actual realizations and qualitative expectations. Under alternative survey data sampling schemes I show how to identify the probability model and estimate the parameters asymptotically efficient using an extended version of Berkson's Minimum Chi-square method, see, e.g., Amemiya (1976, JASA) and Gourieroux (2000, Econometrics of Qualitative Dependent Variables, Cambridge University Press). The approach is simple and requires only familiarity with least squares regression techniques. A Wald test for unbiased expectation formation is derived and based on a small simulation study it demonstrates good finite sample properties. Finally, an application to the SRC consumer survey at the University of Michigan and to the British CBI Industrial Trends Surveys used by Pesaran (1987, The Limits to Rational Expectations, Basil Blackwell) is provided. **Keywords**: Qualitative survey data, Quantification, Tests for unbiased expectation formation.

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DOES INCOME INEQUALITY AFFECT HEALTH? EVIDENCE FROM PANEL DATA

John Asafu-Adjaye*

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This paper investigates the effect of income inequality on health status. A model of health status was specified in which the main variables were income level, income inequality, the level of savings and the level of education. The model was estimated using a panel data set for 44 countries covering six time periods. The results indicate that income inequality (measured by the Gini coefficient) has a significant effect on health status when we control for the levels of income, savings and education. The relationship is consistent regardless of the specification of health status and income. Thus, the study results provide some empirical support for the income inequality hypothesis. **Keywords:** Income inequality; Health; Poverty; Income inequality hypothesis; Panel data

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Details of Sessions: Tuesday

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Session Chairs:

Please notice that session chairs for contributed paper sessions were picked as the last speaker of the session. This is the usual procedure in these meetings. We thank you for your cooperation.

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Tuesday, 9:50 – 11:10 --- Room: Yucatán III

CONTRIBUTED SESSION: STOCK MARKET FORECASTING

Chair: Ercan Balaban

COINTEGRATION AND PERFORMANCE IN LONG-SHORT SECTOR-BASED MARKET NEUTRAL STRATEGIES Claudio Antonini* Viking Asset Management, LLC, cda@alum.mit.edu

Cointegration has been proposed as a tool in the broad (pass/no-pass) selection of stocks used in long-short equity strategies as opposed to correlation (Alexander, 2002). However, no detailed correspondence has been shown between the *t-stats* of cointegrated baskets of stocks (their nearness to unstationarity) and their actual performance in a long-short market neutral strategy. In our case, cointegration techniques are applied to select stocks in sectors of the US equity market, and we analyze the returns, information ratios and other characteristics of performance of buy-hold-sell market neutral strategies as a function of factors such as (a) in-sample design and out-of-sample testing periods, (b) holding period, (c) re-ranking period and (d) index used as reference. Practical considerations are included, such as the effect of commission and slippage.

Keywords: statistical arbitrage, cointegration, correlation, indices, sectors

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DIFFUSION INDICES FOR INTERNATIONAL CAPITAL MARKETS

Daniel Morillo Panagora Asset Management, dmorillo@panagora.com Lawrence Pohlman* Panagora Asset Management, lpohlman@panagora.com

In this paper we apply the diffusion index methodology introduced by Stock and Watson (1998) to global asset markets. S&W provide a method for the construction of diffusion indices based on a large number of variables that is straightforward to implement and yields consistent estimates while allowing for time-variation in factor loadings. In addition an information-criteria based procedure to select the number of factors is integrated with the estimation method and thus provides for automated forecast construction. This method has proved influential and has been tested as in a number of macroeconomic forecasting contexts in various recent papers, including Angelini, Henry and Mestre (2001a) (2001b), Brisson, Campbell and Galbraith (2001), Gosselin and Tkacz (2001) and Bernanke and Boivin (2001). In addition, the method is being used to construct the Chicago Fed National Activity index "CFNAI" (Federal Reserve Bank of Chicago (2000)). We use 1423 key macroeconomic series for 24 developed countries to build diffusion indices to forecast the relative returns for equity markets. In addition to testing the statistical significance of the diffusion indices, we also use the indices as measures of relative values across the countries and build long only and market neutral portfolios to test the economic significance of the diffusion indices. We also compare the Stock and Watson procedure to a classic diffusion index, a random walk and the OECD leading indicators. The major contributions of the paper arises from the application of SW to forecasting international equity markets and the cross sectional application of the indices. We show that scaling the indices by their relative volatilities to a global market index can improve the relative forecast of the diffusion indices.

Keywords: diffusion index, OECD leading indicators, automated forecasts, international equity markets

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THE ACCRUAL AND CASH FLOW COMPONENTS OF EARNINGS PERSISTENCY ON EARNINGS FORECAST IN AN EMERGING MARKET: THE CASE OF THE MEXICAN STOCK EXCHANGE Carlos Trejo-Pech*

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This paper focuses on empirical research that helps to predict profitability. It follows the line of research that questions the extent to which the accrual and cash flow components of earnings persist on future profitability and are appropriately reflected in market values of equity. The results intend to support and extend, as noted by Fairfield et al (2001), the "recent notable contribution... of differential persistence of the accrual and cash flow components of earnings performance and the mispricing of the accrual and cash flow components". This is particularly important given the body of empirical research showing investors (and analysts) fixation on reported earnings, failing to distinguish the difference on the accrual and cash flow components of earnings. Sloan (1996) documented that earnings performance attributable to the accrual components of earnings exhibits lower persistence than earnings performance attributable to the cash flow components of earnings. Also, Sloan's results evidenced that stock prices act as if investors fail to correctly identify that difference. Using the sample period and methodology in Sloan, Fairfield et al (2001) investigated whether the evidence regarding accrued earnings can be generalized to all components of growth in net operating assets. Fairfield et al results evidenced that the market mispricing documented by Sloan (1996) are not limited to accrued earnings, but are also generalizable to the other components of growth in net operating assets. Replicating Sloan and Fairfield et al methodologies with ten years data from Mexican companies listed at the Mexican Stock Exchange, this study hypothesizes that a) the effects regarding accrual and cash flow components of earnings persistency on earnings forecast hold not only in a developed country but also in an emerging market; supporting the idea behind the theory of market efficiency and b) Earnings Before Interest Expense, Taxes, Depreciation, and Amortization (EBITDA), a simplified cash flow indicator fails to substitute cash flow when foresting earnings. Keywords: earnings forecast, México, cash flow

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FORECASTING SYSTEMATIC RISK: EVIDENCE FROM AN EMERGING STOCK MARKET Ercan Balaban* School of Economics and Management Studies University of Edinburgh, Ercan.Balaban@ed.ac.uk Umit Erol Graduate School of Social Sciences, Bahcesehir University, uerol@bahcesehir.edu.tr Murad Kayacan Istanbul Stock Exchange, Murad.Kayacan@imkb.gov.tr

This is a pioneering effort to forecast out-of-sample systematic risk of selected stocks in an emerging stock market of a middle income Eurasian economy, namely Turkey. We employ the historical mean method, the Blume method, and the Vasicek method to forecast daily, weekly and monthly beta coefficients using different estimation periods. The forecast performance is evaluated by using both symmetric and asymmetric error statistics. Overall results show that the simple historical mean method outperforms more complex models. Increasing the length of estimation window significantly improves forecast performance regardless of methods and error statistics. **Keywords**: systematic risk, forecast evaluation, emerging markets

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Tuesday, 9:50 – 11:10 --- Room: Yucatán IV

ORGANIZED SESSION: FORECASTING AND LEADING INDICATORS IN THE EURO-AREA

Organizer and Chair: Domenico J. Marchetti

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TURNING POINT INDICATORS OUT OF BUSINESS SURVEYS: REAL TIME DETECTION FOR THE EURO AREA AND ITS MAJOR MEMBER COUNTRIES Alberto Baffigi* Banca d'Italia, baffigi.alberto@insedia.interbusiness.it Antonio Bassanetti Banca d'Italia, bassanetti.antonio@insedia.interbusiness.it

We present tools for real time detection of turning points in the industrial Production growth-cycle of the euro area and its four largest economies. In particular, we apply a multivariate hidden Markov model (Gregoir and Lenglart, 2000) to national business survey results in order to estimate the probability of expansion and recession phases. The balances of opinions which are used as inputs of the model are selected by ranking them according to the degree of commonality, as estimated through an application of the Generalized Dynamic Factor Model (Forni et al., 2000). The indicators appear to be reliable and stable, with the partial exception of Spain. The paper concludes with some operational hints for practical use of the indicators as a support to short-term economic analysis. **Keywords**: business cycle, hidden Markov model.

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SHORT-TERM ESTIMATES OF EURO AREA REAL GDP BY MEANS OF MONTHLY DATA

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First estimates of euro area quarterly real GDP are published about eight weeks after the end of the respective quarter. In the meanwhile, ongoing economic developments must be assessed from various, more readily available, monthly indicators. This paper examines in the context of univariate forecasting ("bridge") equations to what extent monthly indicators provide useful information for predicting euro area real GDP growth over the current and next quarters. We put particular emphasis on the case of monthly indicators being only partially observed within the quarter. For this purpose, we implement an appropriate monthly updating scheme, which reflects the publication schedules of the particular indicators within the quarter and examine GDP forecasts under different amounts of monthly information. We find that bridge equations based on quantitative activity indicators (i.e. industrial production, retail sales and car registrations) and an equation based on the CEPR EuroCOIN composite indicator result in considerable improvements in predictions for current quarter GDP growth compared with naïve or ARIMA projections. Once unavailable monthly data are forecast from multivariate models, this improvement also extends to predictions for next quarter GDP growth. **Keywords**: Bridge equations, Leading indicators

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COINCIDENT AND LEADING INDICATORS FOR THE EURO AREA: A FREQUENCY BAND APPROACH António Rua* Banco de Portugal, antonio.rua@bportugal.pt Luis C. Nunes

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In the context of a common monetary policy, tracking euro area economic developments becomes essential. The aim of this paper is to build monthly coincident and leading composite indicators for the euro area business cycle. However, instead of looking at the overall comovement between the variables as it is standard in the literature, we show how one can resort to both time and frequency domain analysis to achieve additional insight about their relationship. We find that, in general, the lead/lag properties of economic indicators depend on the cycles periodicity. Following a frequency band approach, we take advantage of this in the construction of the coincident and leading composite indicators. The resulting indicators are analysed and a comparison with other composite indicators proposed in the literature is made. **Keywords**: Coincident Indicators; Leading Indicators; Business Cycle; Spectral Analysis; Principal Components

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LEADING INDICATORS OF ECONOMIC ACTIVITY IN THE EURO-AREA

Antonio Bassanetti Banca d'Italia, bassanetti.antonio@insedia.interbusiness.it Fabrizio Calabrese Banca d'Italia, calabrese.fabrizio@insedia.interbusiness.it Domenico J. Marchetti* Banca d'Italia, marchetti.domenicojunior@insedia.interbusiness.it

This study will analyze the leading properties of a selected set of macroeconomic time-series with respect to Euro-area economic activity, by combining time-series techniques in the time and frequency domain with turning point analysis. The study will eventually lead to the construction of a composite NBER-type leading indicator. **Keywords**: Leading Indicators; Euro area; Turning Point Analysis; Band-pass Filter

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Tuesday, 9:50 – 11:10 --- Room: Mérida II & III

CONTRIBUTED SESSION: COMBINING FORECASTS

Chair: Eva Senra

DECOMPOSITION INTO SINGLE EFFECTS OF THE JOINT COMPATIBILITY TEST FOR RESTRICTED FORECASTING WITH VEC MODELS Nicolás Gómez *

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In an article by Guerrero, Pena, Senra and Alegría (2002), a joint test was proposed for Restricted Forecasting in order to check the compatibility between historical information and Mexican government targets, within the context of a Vector Error Correction model. In this work we present some advances in the understanding of the joint test in terms of the single restrictions involved. It is shown in particular how a matrix associated with uncertainty in the restrictions imposed can be used to cancel out both model dynamics and intercations between restrictions. This fact allows us to obtain the joint restriction test as the sum of the single restriction ones. The empirical work carried out in the previous article is updated by introducing the economic targets announced by the Mexican government at the end of 2002. The results are interpreted in terms of the new economic scenario foreseen for Mexico.

Keywords: Cointegration, compatibility test, multiple time series, restricted forecasting.

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SELECTING AND COMBINING FORECASTS USING EXPERT SYSTEMS

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Improving forecast accuracy is one of the major problems facing most organizations. Somewhat surprisingly in light of the state of forecasting technology, many organizations still do not use a structured forecasting process. Instead they rely on informal approaches often driven by target forecasting. Typically, this methodology results in higher inventories, longer customer lead times, reduced levels of service and bottlenecks. Ongoing empirical evidence continues to suggest that combining forecasts yield improved accuracy and reliability that lead to superior operational efficiencies. Minimizing the loss of information is a basic principle behind the construction of combined forecasts. A key issue in this regard is the procedures used for selecting and combining forecasts. One approach is the use of artificial intelligence (AI) techniques. More specifically, expert systems is one branch of AI that is particularly well suited to help select and combine forecasts. In an expert system "knowledge" is store in a set of if-then rules. The knowledge base can be obtained by interviewing experts or integrating sets of data. Among other things, expert systems can be designed both to be user friendly and to handle quantitative and qualitative factors. Furthermore, the operational characteristics of expert systems help "bring" the manager directly into the forecasting process. The primary purpose of this paper is twofold: to introduce expert systems for selecting and combining forecasts and to compare the performance of expert systems based combined forecasts with traditional forecasting systems. The analysis shows that expert systems holds considerable promise for improving forecast accuracy over a wide range of organizational applications. Keywords: Combining Forecasts, Expert Systems

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COMBINING MACROECONOMIC FORECASTS IN TRANSITION: THE CASE OF POLAND. Michal Greszta* Warsaw University, mgreszta@wne.uw.edu.pl Wojciech Maciejewski

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The paper is a continuation of Wojciech Maciejewski's and Michał Greszta's macroeconomic forecast investigations in Poland, which they began in 1996 at Warsaw University as part of the PHARE project, Independent Macroeconomic Forecasts. Our results (Greszta and Maciejewski, 2002; Greszta, 2002) confirm that an improvement in Polish macroeconomic forecasting accuracy is possible and necessary. Moreover, different forecasts base on different information and to use it one must combine forecasts (see Clemen, 1989; Granger, 1989, and Diebold and Lopez, 1996 for exhaustive reviews). Grajek (2000) was the first to seek to combine Polish forecasts. The advantages of combining forecasts have been confirmed by several research projects - Armstrong (2001) refers to 30 research papers in which the reduction of forecast errors averaged 12.5%, and ranged from 3 to 24%, which demonstrates that combining data has a practical meaning as well. The main goal of this paper is answer the question: how does one go about combining forecasts in transition economies when there are so many forecasters, but with a short history of forecasting. The crucial issue is to determine the relative weights of the combined forecasts. The simplest combined forecast is an arithmetic mean. However, this forecast behaves surprising well compared to other combined forecasts. Other methods differentiate the weights in order to obtain an optimal forecast (with the smallest MSE for example) (variancecovariance and regression methods; non-linear combination; time-varying parameters, and Bayesian methods etc.). We are examining how the above mentioned methods perform in the case of Polish forecasts, in a situation where a small number of observations (years) are available and the possibility of structural breaks occurs. Despite the fact that Polish macroeconomic forecast database (created as a part the Independent Macroeconomic Forecasts PHARE Project) includes more than 10,000 forecasts, after inclusion of 2002 figures, it covers only eight years (and cannot be extended). Therefore, the conditions of our research differ considerably from the research done in countries with a long forecasting history, using time series compiled over decades. This research was conducted using current-year forecasts for the categories with the highest number of observations (GDP, CPI, unemployment rate). Keywords: combining forecasts, economy in transition.

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A FACTOR APPROACH TO COMBINE FORECASTS

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It may be common to have several sources of information that can be used to build different forecasts. The combination of forecasts has been proved as an useful tool to improve forecast accuracy. The kind of information may be handled in different ways: it may come from an expert opinion as well as from a well-defined model. There are several procedures to obtain combined forecasts. This paper considers the usage of factor analysis as (i) a tool to classify the information contained on the forecasts in common and specific, (ii) to produce a consensus forecast and (iii) to reveal opposite information available in different forecasts. We will also compare several methods for forecast combination in terms of the root mean squared error (RMSE) through simulations and real data sets.

Keywords: consensus forecasts, factor analysis, forecast combination.

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Tuesday, 9:50 – 11:10 --- Room: Valladolid

ORGANIZED SESSION: FORECASTING IN TRANSPORTATION II

Organizer and Chair: Peg Young

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FORECASTING TRENDS IN SWISS AIRPORT: BACK FROM THE FUTURE

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With globalisation, economic space has never been so large. The entire world has become a single, huge market. In this context, distances have also increased, leading to greater mobility. Hence the importance of air transport, which saves time – and also money, estimated in the case of the Swiss economy at approximately 10 billion Swiss frances per year. Half the earnings of the Swiss economy come from abroad. Fast, direct access to the different markets around the world is therefore very important, especially when Switzerland's dependence on exports will increase in the future. Among the different economic sectors, metallurgy and the mechanical engineering industry, which occupies a large proportion of the working population, has the highest share of exports (75%). In the case of the tourist industry, the share is approximately 60%. Airports are the indispensable links to the world transport network and today play an important role in the changing international economy, as partners of the airline companies. Airports also represent poles of economic development and are major employers, who provide a significant share of GNP. The terrorist attacks on the Word Trade Centre and the Pentagon in the USA have had important effects on the air transportation industry all over the world. In Switzerland, this has been compounded, in quick succession, by another important event, namely the bankruptcy of the national carrier Swissair. In this paper, the authors analyse the combined effect of these two facts by modelling time series indicators (movements and passengers) using Structural Times Series for the three most important airports in Switzerland, i.e. Unique Airport (Zürich-ZRH), the Aéroport International de Genève (AIG, Geneva-Cointrin) and EuroAirport (Basel). The impact of the two events has not been the same for each one. The paper will show that the impact suffered by AIG is much less important than in the case of the other two. Some considerations about the history of these airports are also presented in order to highlight the results obtained. Keywords: Time series models.

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THE ESTIMATION OF RECENT INTERVENTION EFFECTS IN TRANSPORTATION INDICATORS Keith Ord*

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One year ago the co-authors of this paper created a procedure, using STAMP, to decompose the time series of interest and to create monthly forecasts of Transportation Indicators, taken from a report produced monthly by the Bureau of Transportation Statistics. A fundamental question in the analysis was how to allow for major interventions at the end of a series, such as the tragic events of September 11, 2001. The authors developed a procedure and generated preliminary forecasts, which were presented at ISF'02 in Dublin. We now evaluate this procedure, given an additional year's data, and review the accuracy of those forecasts.

Keywords: Time series decomposition.

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NETWORK STABILITY: A TIME SERIES ANALYSIS OF DOMESTIC AIR TRAVEL Dipasis Bhadra* MITRE, dbhadra@mitre.org Pamela Texter MITRE, ptexter@mitre.org

The U.S. domestic air travel network conveys a lot of useful information, especially at the time of economic transition. As the route structure of low-cost, low-fare airlines grow by connecting point-to-point services, new aircraft types are introduced, and major airlines experience bankruptcies and possible liquidation, the U.S. aviation network is experiencing phenomenal changes. We categorize the U.S. National Airspace System into four broad network groups: (a) hub-and-hub network where both origin and destination airports are hubs; (b) hub-and-spoke network where only the origin airport is a hub; (c) hub-and-spoke network where only the destination airport is a hub; and finally, (d) spoke-to-spoke network where neither airports are hubs. Using passengers' itinerary data, we examine the properties of these networks over time and across segments. In particular, we will develop time-series models for these networks in order to examine policy and investment implications for the National Airspace System and its users. **Keywords**: Policy examination.

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ISSUES IN DEVELOPING A TRANSPORTATION INFRASTRUCTURE INDEX Brian W. Sloboda* US Department of Transportation, brian.sloboda@bts.gov Herman Stekler

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Lahiri et. al. (2002) presented the theoretical development, selection, and the testing of the Index of Output of Transportation Services. This Index serves as a coincident indicator of economic activity in the services sector of the transportation industry. This monthly index of transportation output covers the period of 1980:1-2002:12, and measures the economic activity for the transportation modes of air, rail, water, truck, transit, and pipelines. However, this Index only measures the activity of the transportation services sector while the transportation industry also includes the transportation equipment and transportation infrastructure sectors. This paper will explore in detail the data and classification problems that are involved in developing a measure of economic activity in the infrastructure sector of the transportation industry.

Keywords: transportation output index, transportation infrastructure

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Tuesday, 9:50 – 11:10 --- Room: Mérida I

ORGANIZED SESSION: LONG MEMORY MODELING

Organizer and Chair: Wilfredo Palma

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BOOTSTRAP APPROACHES ON THE PARAMETER ESTIMATION OF ARFIMA MODELS

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This work considers different bootstrap procedures for investigating the estimation of the fractional parameter d in a particular case of long memory processes, i.e. for ARFIMA models with d in (0.0,0.5). We propose two bootstrap techniques to deal with semiparametric estimation methods of d. One approach consists of the local bootstrap method for time frequency initially suggested for the ARMA case by Paparoditis and Politis [*Journal of Time Series Analysis*, 20(2), 1999] and the other consists of the bootstrapping in the residuals of the frequency-domain regression equation. Through Monte Carlo simulation, these alternative bootstrap methods are compared, based on the mean and the mean square error of the estimators, with the well-known parametric and nonparametric bootstrap techniques for time series models. Bootstrap tests for the parameter d are also evaluated and compared to the asymptotic test.

Keywords: Semiparametric procedures, ARFIMA process, Bootstrap in the residuals, Local bootstrap, Regression bootstrap.

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LONG-RANGE DEPENDENCE AND REGIME-SWITCHING MODELS Bonnie K. Ray*

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We discuss the relationship between long-range dependence and regime-switching models, and introduce the Semi-Markov Regime Switching Model (SMRSM) for characterizing long-range dependent behavior generated through a nonlinear, regime-switching mechanism. Fundamental properties of the SMRSM are given and the performance of commonly used tests for determining the existence of LRD in the linear case are investigated for the proposed nonlinear model via simulation. We also briefly discuss the ability of nonlinearity tests to determine the nature of the observed long-range dependence, *i.e.* whether it is generated by a linear or a nonlinear mechanism. Examples are given in the context of modeling Web server traffic intensities.

Keywords: Long memory, Markov-switching, nonlinearity

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THE BIAS OF THE ESTIMATORS ON SEASONAL ARFIMA PROCESSES Valdério A. Reisen* DEST-CCE-UFES, valderio@cce.ufes.br Alexandre Rodrigues UFES, xandellr@ig.com.br

In this paper we present the estimation of the fractional ARFIMA process with seasonal components. The fractional semiparametric estimator Geweke & Porter-Hudak (1983) is considered in different frequency ranges chosen around the seasonal frequencies. The performance of the method is investigated through Monte Carlo simulation. Keywords: Fractional differencing, long memory, periodogram regression, seasonality

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CONDITIONAL LONG-MEMORY PROCESSES

Mauricio Zevallos-Herencia* Universidad de Santiago de Chile, mzevallo@usach.cl Wilfredo Palma Pontificia Universidad Católica de Chile, wilfredo@mat.puc.cl

This article discusses a new methodology for modelling time series with long range dependence. The class of models proposed admits continuous or discrete data and consider the conditional variance as a function of the conditional mean. This type of models are motivated by empirical properties exhibited by some time series. The proposed methodology is illustrated by the analysis of a real-life long-memory time series

Keywords: ARFIMA; conditional variance; quasi maximum likelihood; prediction.

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Tuesday, 9:50 – 11:10 --- Room: Santa Lucía

CONTRIBUTED SESSION: NEURAL NETWORKS III

Chair: Reinaldo C. Souza

FORECASTING WIND SPEED AND ORIENTATION IN A WIND FARM

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The wind is the principal agent during the process of power generation in a wind farm; in order to make a correct planning of the system in real time (starting, orientation, stopping), forecasts of speed and orientation of the wind have to be calculated for 24 to 30 hours. The accuracy of these forecasts may help in the management of wind farms, avoiding stability problems that may occur in the electric power net due to eolic generation. The methodology used in this job to calculate forecasts is Artificial Neural Networks; forecasting models will incorporate the influence of previous wind measures at the same place, and the potential relationships of wind speed in different spatial spots. **Keywords**: wind farm, forecasting, neural nets.

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GEOMETRY OF THE PERCEPTRON ALGORITHM J. C. P. Sampson* Departamento de Ingeniería Industrial y de Sistemas, ITESM-CEM, jonathancsampson@yahoo.com Erik Honobe Departamento de Finanzas y Economía, ITESM-CEM, ehonobe@itesm.mx

A new visualization of the object and process of perceptron learning is presented. From this reformulation, we derive a geometric proof of convergence for a generalized application of the perceptron learning algorithm. **Keywords**: neural networks, geometry, information geometry, algorithm.

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NFHB-P: AUTOMATIC ELETRIC LOAD FORECASTING THROUGH AN HIERARCHICAL NEURO-FUZZY MODEL Elma Suema Trevisan Department of Electrical Engineering, PUC-Rio, elmatrevisan@terra.com.br Katia Saez Carrillo* Facultad de Ciencias Físicas y Matemáticas, Universidad de Concepción, katiasaez@bol.com.br Flávio Joaquim de Souza Computer Systems Department, UFRJ, fjsouza@eng.uerj.br Reinaldo Castro Souza Department of Electrical Engineering, PUC-Rio, reinaldo@ele.puc-rio.br

This work aims to develop a hybrid neurofuzzy model for generic data forecasting. In general, these hybrid models are powerful due to merging several AI advantageous techniques (e.g. Neural Networks and Fuzzy Inference Systems). This works roots on the Neuro-Fuzzy Hierarchical BSP (Binary Space Partitioning) – NFHB – developed by Flavio Joaquim de Souza (SOUZ99), that uses recursive BSP to create rules hierarchy. It maintains the interpretability of mapping input-output spaces and poses clever strategies to optimize the selection of input variables. The methods employed here are based on the neurofuzzy approach, using a parallel distributed network architecture in such a way to take the best from both fuzzy and neural processing algorithms. They share the capacity of improvingly performance even at the presence of uncertainty, imprecision and noise. Their advantage upon classical methods relies on the design of a transfer function even without a mathematical description on input-output relationship. This supervised learning has brought outstanding forecast results in extracting and producing experimental knowledge. The hierarchical neurofuzzy model developed for forecasting – denominated NFH-P – is capable of forecasting medium term electrical load from historical data, while selecting the most representative input variables. The NFH-P is a compact, robust structure, yielding powerful parameter generalization, a set of causal rules, selection the most representative variables, with excellent result when benchmark compared.

Keywords: neuro-fuzzy, binary space partitioning, hybrid systems, load forecasting.

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AUTOMATIC IDENTIFICATION OF BOX & JENKINS STRUCTURES THROUGH NEURO-FUZZY NETWORKS

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This paper presents a procedure based on fuzzy logic and neural networks for structural identification of non-seasonal Box & Jenkins time series. The reasoning process is expressed by linguistic, or fuzzy, rules and attempts to emulate the one used by specialists in the identification of those structures. Presented with the autocorrelation and partial autocorrelation functions, neuro-fuzzy networks are specially trained to identify five different types of structures. Results obtained outperform those provided by an existing expert system and confirm the applicability of the proposed methodology.

Keywords: Box & Jenkins models, identification, neural networks, fuzzy logic, neuro-fuzzy networks.

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Tuesday, 11:25 – 12:25 --- Room: Yucatán III

ORGANIZED SESSION: DATA QUALITY AND FORECASTS

Organizer and Chair: Lars-Erik Öller

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REVISIONS OF SWEDISH NATIONAL ACCOUNTS 1980-1998 AND AN INTERNATIONAL COMPARISON

Lars-Erik Öller Statistics Sweden, lars-erik.oller@scb.se Karl-Gustav Hansson* Statistics Sweden

A revision generally augments a preliminary growth rate. The revision distributions are skew, often with fat tails of outliers. For some Swedish variables, including GDP, revisions are correlated with the business cycle. This is also true of most European GDP revisions. Growth rates are revised upwards in upturns and downwards in downturns, and this also results in a tendency toward bimodality in the frequency distributions. We identify where in the accounts the greatest benefits from increased reliability may be achieved. In the international comparison Canada has the smallest revisions.

Keywords: Frequency distributions.

* Statistics Sweden, SWEDEN

FORECASTS AS IMPUTATIONS, USING ARIMA AND TRANSFER FUNCTION MODELS Petra Jansson Statistics Sweden and Stockholm University Maria Krigsman Statistics Sweden and Stockholm University Lars-Erik Öller* Statistics Sweden and Stockholm University, lars-erik.oller@scb.se

The presence of nonresponse is a source of inaccuracy in preliminary data, and has been a matter of concern for decades. There are several conventional methods of dealing with missing values. Disadvantages associated with the commonly used methods are that *(i)* they may not efficiently use the available information and, *(ii)* they often lack transparency and objectivity. This paper examines the use of ARIMA and transfer function forecasts for imputation, efficiently combining temporal and spatial forecast information and assuring transparency and objectivity. **Key words:** nonresponse, imputation, TRAMO/SEATS, ARIMA, transfer function

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HOW ACCURATE ARE THE SWEDISH FORECASTERS ON GDP, CPI AND UNEMPLOYMENT? (1993 – 2001)

Bharat Barot*

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This study evaluates the performace of the Swedish domestic forecasts of real GDP growth, CPI and unemployment for the sample period 1993-2001. The Swedish forecasters under scrutinization are the National Institute of Economic Research, the Ministry of Finance, Confederation of Swedish Enterprise, Handelns Utredningsinstitut, the Swedish Central Bank, Handelsbanken, Nordea, and finally the SEB group. The forecasts that are evaluated are the spring, summer, autumn and the december forecasts. The questions addressed are the following: Has the mean absolute error and the root mean square error delined over the different forecasting occasions? Have the Swedish forecasters been able to predict the directional accuracy correctly? Have the Swedish forecasters been able to beat the naive random walk and the random walk model with drift? Have the forecasts been biased tending to systematically underpredict or overpredict GDP growth, CPI and unemployment?. Have the Swedish forecasters been able to perfrom better with preliminary or final gdp actuals? Are the current year forecasts better than a year ahead forecasts? The results indicate that the average errors are large in terms of both their variance and the importance of the variables. The current forecasts compared to the a year ahead forecasts decline over the forecasting horizons as more information becomes available. The results with respect to the directional accuracy indicate that we are equally good/bad in predicting the directional accuracy for GDP, CPI and the unemplyment variable. According to the comparisons with the naive random walk model six out of seven Swedish CPI forecasters were beaten by the naive random walk model. Tests of bias indicate that the Swedish forecasters underestimate GDP and overestimate CPI and the unemployment rate for the sample period. All the Swedish forecasters have been successful in predicting the downward trend in CPI and the unemployment rate. The performance of the Swedish domestic forecasters is better using preliminary GDP outomes than final.

Keywords: Mean absolute error, root mean square error, directional accuracy, bias, revisions.

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Tuesday, 11:25 – 12:25 --- Room: Yucatán IV

CONTRIBUTED SESSION: JUDGEMENTAL FORECASTING II

Chair: Paul Goodwin

STRUCTURED ANALOGIES: A NEW METHOD FOR FORECASTING DECISIONS IN CONFLICTS Kesten C. Green*

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Structured analogies (SA) is a formal approach to using analogies for forecasting decisions in conflicts. I recruited 48 experts and asked them to forecast the decisions made in eight diverse conflicts. For example, how a stand-off between an acquisitive telco and a potential acquisition would be resolved. The experts were told to (1) think of analogous conflicts; (2) rate them for similarity to a target conflict; (3) identify the target conflict decisions implied by the outcomes of the analogous conflicts; and (4) derive a forecast for the target conflict based on this information. The SA forecasts were more accurate when the experts were confident in their forecasts (61% vs 31%). Forecasts were more accurate when experts were able to think of two or more analogous conflicts from their own direct experience (69% vs 46%). When experts provided forecasts that were inconsistent with their own analogies, accuracy was reduced (13% vs 56%). Overall, forecasts from SA were more accurate (45%) than forecasts by game theorists (32%) and from unaided judgement by experts (34%). They were, however, less accurate than forecasts derived from simulated interaction (62%).

Keywords: game theory, judgement, role playing, simulated interaction, structured analogies.

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THE CONTINGENT UTILITY OF CONFIDENCE INTERVALS AND OTHER FORMS OF UNCERTAINTY INFORMATION IN FORECASTING AND DECISION-MAKING Michael Nelson * School of Information Systems, Technology & Management, University of New South Wales,

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When point forecasts are provided as inputs to decision-making, additional 'uncertainty information' (UI) describing confidence in the forecast can be communicated in formats such as a range, confidence interval or probability distribution. People are poor judges of uncertainty so the provision of objective UI should improve decision-making. However, despite normative and rational benefits, decision-makers do not consistently utilize UI. For example, traditional accounting and financial reporting practices do not require the explicit reporting of probabilistic information. This contradictory situation has led a small number of researchers to investigate the impact of providing financial reports with UI. These studies have produced inconclusive results, but one message is clear: the benefits of UI appear to be highly contingent. While the downstream utilization of UI has received little attention in the literature, the upstream production and calibration of subjective UI has produced a significant amount of research. Recent research into the calibration of people's decision confidence has highlighted a preference for being informative rather than achieving accuracy (Yaniv & Foster, 1995). This shows people think about the way in which UI will be received, and further emphasizes the need to understand UI utilization in addition to UI production. Our knowledge of the contingent utilization of objective UI requires the same effort already put into understanding the upstream, production and calibration of subjective UI. This paper presents a model based on a modified decision-making framework (Beach & Mitchell, 1978) describing those task-person-environment factors most likely to influence the utility of UI. The influence of factors such as target levels, the format of UI, changes in task uncertainty and the presence of a forecast are discussed. The contributions of past and recent studies will be reviewed, the results of a new study presented, and prescriptions for future research provided.

Keywords: Confidence Intervals, Decision-Making, Judgmental Forecasting, Uncertainty Information

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DECISION MAKING USING TIME SERIES INFORMATION UNDER CONDITIONS OF ASYMMETRIC LOSS Paul Goodwin*

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In an experiment decision makers used time series information on the past demand for products to decide on production levels to meet the next period's demand. Either shortages cost more per unit than surpluses or the asymmetry of losses was in the opposite direction. The decision makers were either: i) unsupported, ii) provided with statistical point forecasts of the next period's demand or iii) asked to estimate probability distributions of next period's demand using the fractile method –the decisions were inferred from these distributions (Decomposition). Providing statistical forecasts led to decisions incurring significantly lower expected costs than those achieved by the unsupported decision makers. However, the decomposition procedure did not significantly reduce expected costs because, contrary to earlier evidence, the fractile method generally led to distributions that were hypoprecise. Decision makers in both treatments (i) and (ii) also performed significantly better when shortages were more costly than surpluses **Keywords**: Judgmental forecasting, decision making.

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Tuesday, 11:25 – 12:25 --- Room: Mérida II & III

CONTRIBUTED SESSION: DATA MINING

Chair: Michael Leonard

DATA MINING MICROSOFT EXCHANGE SERVER PERFORMANCE DATA TO IDENTIFY PREDICTOR VARIABLES FOR USE IN MULTIVARIATE REGRESSION EQUATIONS THAT FORECAST SERVER UTILIZATION Anthony C. Waclawski*

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Text based electronic mail systems such as PROFS, SYSM, and Memo have existed for many years. These computationally inflexible, highly centralized systems are primarily hosted on mainframe computers. The enormous popularity of PCs eventually transferred much of the messaging burden from mainframes to the desktop. Users began communicating with each other over Local Area Network computing environments. The relatively simple engineering schema of LAN-based or shared-file messaging occurs within an environment where the client desktop initiates and controls all messaging activity. When a user sends a message from their PC, client software transmits the message to a specific directory on a remote "mail server" where the recipient retrieves it by accessing their appropriate mailbox directory. Due to the limited scalability, propensity to increase network traffic and concerns about read/write access security coterminous with LAN based systems; client/server messaging architecture was developed to distribute the necessary processing. These systems are engineered such that when a user sends a message the server is "intelligent" enough to place it in the appropriate server queue for processing. The recipient, using Remote Procedure Call technology, then receives the message. The pervasiveness of client/server messaging architecture as the "tool of choice" for written communication has exponentially increased the volume of daily transactions that must be processed by client/server environments. In order to support this growth corporations typically purchase numerous high capacity "mail servers" and geographically disperse them within data centers. In order to effectively manage their substantial investment in these computing resources decision-makers require accurate forecasts of workload performance in order to either scale their messaging infrastructure to accommodate new business growth or to sell unused capacity. This paper describes the use of data-mining as a tool to specifically identify major performance metering records that are statistically significant predictors of CPU consumption for Microsoft Exchange servers. Keywords: Data Mining, Forecasting, Performance, LANs, Servers

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NAÏVE MODELS: MERITS AND SHORTCOMINGS Joseph Somma* HSBC Bank USA. Joe.Somma@us.HSBC.Com Herbert Heldman Heldman Associates, Inc. Herb@berk.com

Deposit and loan activity forecasting applications with respect to demand type deposits will be the focus of the paper. Separate analyses will be pursued of consumer and business type demand deposits. Comparative results obtained using both naïve and sophisticated modeling techniques will be examined. The applications grow out of a data mining and trend evaluation exercise in market settings with significant differences. HSBC offers unique opportunities to examine these issues since it operates in the US, Canada and UK, and in markedly different settings in each nation. Thus, three geographically distinct markets will be examined: a) in the US, Erie County; b) in Canada, Vancouver metropolitan area; and c) in the UK, the Sheffield metropolitan area. Basic issues to be addressed include: a) relative costs versus marginal gains in reliability; b) defensibility of key parameters; c) data manageability and system maintenance; d) communication and confidence issues; e) structural change and credibility in dynamic environments. Multi-national banks have to address the same kinds of development and forward management issues in different economic and cultural settings. The data banks describing experience in their several markets vary in depth and characteristics. At issue is the extent to which a) the systems designed for use with rich databases can be generalized, simplified, stripped down for use in less richly endowed data environments, b) the extent to which the nature of individual markets mandates the development of modeling techniques unique to the particular market. The paper will explore how models that appear naïve in a rich information environment fare as compared with the more elaborate models typically developed for use in such settings. And how well complex models travel as between up-scale and down-scale markets. The discussion also will consider the efforts to devise a matrix that describes increments in cost and confidence so that an optimum tradeoff can be approximated. A further concern will be how the matrix changes in character as between one-time applications and systems designed for iterative use in a periodic market audit context. Keywords: Forecasting. Naïve Models. Data Mining. Market Differentiation.

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MINING TRANSACTIONAL AND TIME SERIES DATA Michael Leonard* SAS Institute Inc. Cary, NC, USA

Web sites and transactional databases collect large amounts of time-stamped data related to their suppliers and/or customers over time. Mining this time-stamped data can help business leaders make better decisions by listening to their suppliers or customers via their transactions collected over time. A business can have many suppliers and/or customers and may have a set of transactions associated with each one. However, the size of each set of transactions may be quite large making it difficult to perform many traditional data mining tasks. This paper proposes techniques for large-scale reduction of time-stamped data using time series analysis, seasonal decomposition, and automatic time series model selection. After data reduction, traditional data mining techniques can then be applied to the reduced data along with other profile data. This paper demonstrates these techniques using SAS/ETS®, Enterprise Miner®, and SAS® High-Performance Forecasting Software.

Keywords: Time Series Analysis, Time Series Databases, Temporal Data Mining, Data Mining

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Tuesday, 11:25 – 12:25 --- Room: Valladolid

CONTRIBUTED SESSION: BAYESIAN MODELING

Chair: Omar Aguilar

ALTERNATIVE TIME VARYING PARAMETER SPECIFICATIONS FOR BAYESIAN VAR MODELS

Gianni Amisano* Department of Economics, University of Brescia, amisano@eco.unibs.it Loredana Federico Department of Economics, University of Pavia, lfederico@eco.unipv.it

We discuss the results of a comparison of different time varying parameter mechanisms to capture drifts in coefficients in a three-variable VAR for the Euro area. We start with a general prior model specification that accounts for correlation between the measurement and transition innovations and we progressively impose prior restrictions on the parameter space. The most restricted version of the model is a hierarchical Litterman-type BVAR model. We exploit the potentialities of Markov Chain Monte Carlo Methods (MCMC) in 1) simulating the marginal posterior distribution of all parameters; 2) in computing the marginal likelihoods of the models and the resulting posterior odds ratios; 3) I n deriving the posterior predictive density of the models and using them to update the posterior densities of the parameters. This last point allows us to conduct a classical comparison of the forecasting accuracy of the models. We observe that to manage general model specifications in a multivariate framework induces still huge problems. For model adequacy analysis, the marginal likelihoods of some models cannot be computed at the desired level of accuracy, even if we use several alternative approaches. In model prediction, by imposing restrictions in the time variation of the parameters, we improve the forecasting performances. Another practical problem that we find in the most restricted model, where the parameter time variation is governed by a single parameter, is that the resulting Gibbs chain is very highly correlated and this requires very long chains and therefore long simulation computer sessions. A way out to these problems that we propose is to use a Kronecker structure on the state equation errors variance covariance matrix. This choice allows us to obtain also good forecasting performance.

Keywords: Euro area forecasting, Bayesian inference, MCMC, time varying parameters.

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FORECASTING WITH MANY PREDICTORS Jana Eklund* Stockholm School of Economics, Jana.Eklund@hhs.se Sune Karlsson Stockholm School of Economics, Sune.Karlsson@hhs.se

The problem of having to select a small subset of predictors from a large number of useful variables can be circumvented nowadays in forecasting. One possibility is to efficiently and systematically evaluate all predictors and almost all possible models that these predictors in combination can give rise to. This paper explores the idea of combining forecasts from various indicator models by using Bayesian Model Averaging (BMA), and compares BMA to other recently proposed methods using large number of predictors to forecast. The work by Karlsson and Jacobson (2002), where Bayesian techniques are used to select forecasting models for the Swedish inflation rate, concludes that forecasts based on BMA outperform forecasts based on a single model. Another approach, considered by Stock and Watson (2002), uses diffusion indexes to forecast eight U.S. macroeconomic variables. Their approximate dynamic factor model outperforms most of the conventional time series forecasts. This paper compares both methods on two distinct data sets with focus on forecasting the CPI and the inflation rate. The first data set consists of monthly U.S. macroeconomic time series with 215 predictors from 1970 through 1998, and the second contains quarterly Swedish macroeconomic time series with 86 potential predictors from 1983 up to 2000. In addition we also consider forecasts based on the median model as suggested by Barbieri and Berger (2002).

Keywords: Bayesian Model Averaging, Markov chain Monte Carlo, Variable selection, Diffusion indexes, Inflation rate.

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BAYESIAN TIME SERIES ANALYSIS OF INVESTMENT ROTATION STRATEGIES: AN STUDY OF THE S&P500 RETURNS Omer Aquilar*

Omar Aguilar* Lehman Brothers, omar.aguilar@lehman.com Viridiana Lourdes ITAM and BEST, LLC vlourdes@itam.mx

We discuss a general class of Bayesian Dynamic Linear Models for financial time series. These models focus on explaining the behavior of stock market indices through a strategy that shifts the exposure among various industrial sectors. Bayesian inference and computation is developed and explored in a study of the industry composition of the S&P 500 index returns. The models exploit the return predictability of some economic sectors and industries and their contribution to the market performance. We review empirical findings in applying these models to different industry rotation strategies, including aspects of model performance in dynamic portfolio allocation. We discuss model assessment, residual analysis and MCMC algorithms developed to fit this class of models and conclude with comments on future potential developments together with model extensions.

Keywords: Dynamic Linear Models, Asset Allocation, Bayesian inference, Optimal portfolios.

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Tuesday, 11:25 – 12:25 --- Room: Mérida I

CONTRIBUTED SESSION: FORECASTING INFLATION II

Chair: Ernesto Acevedo

INFLATION FORECASTING AND A NONLINEAR LONG MEMORY MODEL Sang-Kuck Chung*

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We examine out-of-sample forecasting of monthly postwar US core inflation and log difference price levels. We observe two important empirical properties of US inflation; shocks to the series seem rather persistent and it seems to rise faster during expansions than that it falls during recessions. To jointly capture these features of long memory and nonlinearity, we consider a new time series model and evaluate its empirical performance. We find that the model describes the data rather well and that it outperforms related competitive models from the forecasting perspective. **Keywords:** Fractional Integration; Inflation; Smooth Transition; Time series

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INFLATION FORECASTS FOR THE EURO AREA: COMPARING LINEAR AND NON-LINEAR MODELS

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The performance of linear vs. non linear models is currently one of main debated issues in the econometric literature (see, for example, Granger and Terasvirta, 1993). Particularly, the "value added" of the non linear models in terms of forecasting accuracy has been questioned; among others, Stock and Watson (1999) propose a comparison for a large set of variables for the US; a similar exercise was performed by Marcellino (2002) to about 500 macroeconomic variables for the Euro area. In our view, comparing the forecasting performance of linear and non-linear methods is particularly important with reference to the inflation rate: a deeper investigation of inflation dynamics is crucial in order to design and to assess the impact of monetary policy, particularly in the light of the European Central Bank concern for price stability. The aim of the paper is to estimate both linear and regime-switching models in order to provide competing forecasts of the rate of inflation in the euro area. In particular, we focus on consumption price indexes for Italy, France, Germany and Spain, by using long time series (monthly data from 1960). First, the forecasting performance of smooth transition autoregressive models (STAR), as compared to ARIMA specifications, is assessed: main forecast diagnostics, such as ME, MAE and RMSE errors, calculated over a long in-sample time horizon, are presented. Moreover, the differences between the above set of models, are evaluated by performing the Diebold-Mariano (1995) and Fair-Shiller (1990) forecast encompassing tests. The results of an extensive range of forecast evaluation techniques are first presented for each country separately. As a further step, in line with the approach followed, among others, Marcellino, Stock and Watson (2001), the possibility to develop an aggregate CPI index in order to forecast inflation for the euro area as a whole is investigated.

Keywords: Regime-switching models, ARIMA models, forecasting, model evaluation

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INFLATION AND ECONOMIC GROWTH IN MEXICO: A NON-LINEAR RELATIONSHIP Ernesto Acevedo*

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Nowadays that Banco de Mexico has adopted an inflation targeting scheme it has becomes more relevant to know the effect that moderate inflation has on economic growth in order to design monetary policy. The purpose of this paper is to estimate that effect and provide Banco de Mexico with useful elements of analysis to define efficient inflation targets. The non-lineal approach followed in this document is similar to that proposed by Sarel (1996). The results are robust and statistically significant. Moreover, they are consistent with the findings of Sarel (1996) and Judson y Orphanides (1996), and show that economic growth in Mexico increases with rates of inflation that are lower than 9.1 percent (or 8.7 percent if core inflation is used); higher rates of inflation damage the rate of economic expansion. In light of these findings, monetary policies aiming at very low rates of inflation are not optimal given the excessive costs that are implied in terms of economic growth.

Keywords: Inflation, economic growth, monetary policy.

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Tuesday, 13:45 – 14:45 --- Room: Yucatán III

CONTRIBUTED SESSION: FORECASTING AND SOCIAL ISSUES I

Chair: Wilpen L. Gorr

THE CDC VACCINE MONITORING AND ALLOCATION MODEL (VMAM): ASSURING EQUITABLE VACCINE DISTRIBUTION DURING THE U.S. VACCINE SHORTAGES.

Gary Coil*

Public Health Advisor, National Immunization Program, Centers for Disease Control and Prevention (CDC), ggc3@cdc.gov

Pediatric vaccines purchased through contracts negotiated by the Centers for Disease Control and Prevention (CDC) represent between 50-60% of the US market share. The CDC reviews and approves approximately 350 vaccine orders a day from 64 authorized immunization projects. The current annual value of CDC vaccine purchases is over \$1 billion dollars. In late CY 2000, the U.S. began to experience spot shortages in DTAP vaccine supply. By mid-2001, severe vaccine shortages had developed in several other pediatric vaccines (MMR, varicella, and pneumococcal conjugate) resulting from regulatory compliance issues, limited production capacity, transitioning to thimerosal-free presentations, and manufacturer decisions to withdraw products from the market. CDC's primary strategy for assuring equitable distribution of vaccines in short supply among the 64 immunization projects was the development of a valid and reliable model for monitoring and allocating vaccines. Functional requirements called for daily model output with dynamic adjustments for project population eligibility, reported vaccine inventory levels, vaccine backorder amounts, and yearto-date status in meeting estimated need based on vaccine received. In March 2001, the CDC implemented the Vaccine Monitoring and Allocation Model (VMAM). It incorporates US Census projections, current vaccine recommendations, project estimates of population eligibility, year-to-date vaccine purchases, backorder status, and monthly inventory status. The VMAM allows users to scenario model project allocations by dynamically adjusting pipeline/inventory amounts, the population eligibility, and the number of doses per eligible child for each vaccine and project. CDC has recently incorporated VMAM into its daily business process for vaccine order approval, assuring that allocation decisions are not only equitable, but based on standard, measurable criteria. Using VMAM output, the CDC now directs vaccine manufacturers to deliver backordered vaccines in short supply to projects exhibiting the greatest need. **Keywords:** Allocation model, vaccines

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STRONG SEASONALITY VERSUS WEAK SEASONALITY IN TOURISM FORECASTING Nada Kulendran*

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Seasonality is an important issue in international visitors arrivals. Different types of travel such as holiday, business and visiting friend and relatives across country exhibit either strong or weak seasonality. Seasonal effects contribute more than 85% of the variation in quarterly holiday international visitor arrivals. Seasonal variations in international visitor arrivals data are either deterministic or stochastic. The possible order of integration of seasonal visitor arrivals timeseries are I(1,1), I(1,0), I(0,1) and I(0,0). To forecast international visitor arrivals, previous tourism forecasting studies considered seasonal ARIMA models with first differences and seasonal dummies and seasonal ARIMA models with first and fourth differences to accommodate only I(1,1) and I(1,0). The forecasting models in this paper will consider all possible order of integration I(1,0), I(1,1), I(0,1) and I(0,0), which was also considered by Osborn etc(1999). The post-sample forecasting accuracy of the models in this paper will be use to assess the usefulness of seasonal unit root tests such as HEGY(1996) and seasonal \mathbb{R}^2 value with the view of selecting the best short-term tourism forecasting model for different type of travel across country.

Key words: seasonality, unit root testing and tourism forecasting

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A SPATIAL ECONOMETRIC MODEL FOR SEASONALITY ESTIMATION: APPLICATION TO CRIME FORECASTING

Jacqueline Cohen Carnegie Mellon University, jc63@andrew.cmu.edu Wilpen L. Gorr* Carnegie Mellon University, wg0g@andrew.cmu.edu

It is desirable to strengthen seasonality estimates by pooling data from analogous observation units. In the past, efforts for this purpose have centered around Bayesian pooling; however, in this paper we advocate a spatial econometric model based on classical decomposition. The area of application for our research is crime forecasting, which is characterized by space and time series data consisting of crime counts over a spatial grid and by month. We start with a fixed-effects model to remove spatial variation in crime patterns including grid cell dummies, a cubic in time, and interactions of those two components. We assume remaining variation to be attributable to seasonality and randomness. The model for seasonality is drawn from the crime ecology literature, leading to several measures based on population and land use variables within grid cells. We pass these measures through principal components analysis, yielding five factors. The seasonal component of the model thus includes monthly dummies as main effects and those same variables interacted with the five principal components. A validation study uses 10 crime types collected over 96 months and across 103 grid cells. The forecast method is Holt exponential smoothing with data deseasonalized by classical decomposition versus the new spatial econometric model. A rolling horizon experimental design for one-month-ahead forecasts yields over 36,000 forecasts. On average, the forecasts using the spatial econometric model for seasonality are 28% more accurate than those from classical decomposition. The reason for such large improvements is that crime seasonality has much spatial heterogeneity, with different kinds of neighborhoods even having opposite seasonality patterns.

Keywords: Seasonality, Pooling, Crime Forecasting, Spatial Econometrics

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Tuesday, 13:45 – 14:45 --- Room: Yucatán IV

ORGANIZED SESSION: TELECOMM FORECASTING II

Organizer and Chair: Mohsen Hamoudia

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BROADBAND FORECAST MODELLING FOR WESTERN EUROPE. EVALUATION OF METHODOLOGY AND RESULTS

Kjell Stordahl*

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The first part of the paper gives a review of broadband forecasts and broadband forecasting methods, which have been applied in EU projects during the last 8 years to predict the broadband evolution in Western Europe. It is documented that the Delphi survey has developed rather good long-term forecasts based on surveys carried out in 1994 and 1997. The second part of the paper presents demand modelling and forecasts for different access technologies in the fixed network based on results from the IST-project Tonic (TechnO-ecoNomICs of IP optimised networks and services). The demand modelling and broadband forecasts are important input to techno-economic business case analyses in the Tonic project. A model has been developed for forecasting the total broadband penetration in West European residential market. Forecasts are made from 2003 to 2010 based on diffusion models. Specific models are developed to predict the market share evolution between ADSL, VDSL, fixed wireless broadband and cable modem/HFC Penetration forecasts for the different access technologies are presented. Important elements in the predictions are techno-economic calculations of the expected profit of the relevant broadband technologies for different type of access area. A key factor is coverage predictions for each broadband technology.

Keywords: Long-term broadband forecasts, Delphi survey, Diffusion models, Markets share predictions

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FORECASTING THE GROWTH OF THE MOBILE MULTIMEDIA SERVICES Mohsen Hamoudia* France Telecom, Paris, France, mohsen.hamoudia@francetelecom.com Towhidul Islam Department of Consumer Studies, University of Guelph, Ontario, Canada, islam@uoguelph.ca

The diffusion and extend of the success of new mobile terminals and the new services will largely depend on the ability of the telecommunications services sector in Europe to remain a growth markets. The real start of mobile multimedia services in Europe in 2002 will have a high and significant impact on the global demand for the Mobile Sector. The Mobile Multimedia includes many services such as SMS, MMS, communities services (chat, forum, dating), SMS games, votes, TV games, handset personalisation, M-Services (banking, booking, ticketing), video (downloads, streaming), and other new services. The aim of this presentation is to develop forecasting models with basic diffusion models and traditional econometric methodology. The forecasts from these models are compared. **Keywords**: Mobile Telecommunications, Multimedia services, Diffusion of Innovations

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TELECOMMUNICATION CALL CENTRE TRAFFIC FORECASTING BY BOX-JENKINS TECHNIQUE: A REAL LIFE CASE STUDY Neelesh Kumbhojkar Center of Excellence- Network Design Engineering Mahindra-British Telecom Limited, neeleshk@mahindrabt.com Praveen Kumar Center of Excellence- Network Design Engineering Mahindra-British Telecom Limited, praveenk@mahindrabt.com N. N. Rao* Center of Excellence- Network Design Engineering Mahindra-British Telecom Limited, raon@mahindrabt.com

Forecasting based on time series analysis has emerged as one of the most important and widely used branches of statistics. Application of forecasting methods to real life data is challenging due to very large size of the data, high dimensionality and presence of seasonal variations. Telecommunication is a field where forecasting models can be of great help. A call center handles various types of customer services. The working day of a call center is divided in to number of equal time slots of duration 15 or 30 minutes each. Forecasting the telecommunication traffic volume for each time slot for the forthcoming day(s) is of paramount importance for planning sufficient resources to provide satisfactory customer service. Box-Jenkins method normally applied to univariate time series required at least 50 successive observations for forecasting. In this paper, Box Jenkins method is applied successfully for 120 (30 minutes) data sets, each having only 40 data points. The success of Box-Jenkins process crucially depends on the trend and seasonality identification and removal. The trend and seasonality is identified and removed by an automatic approach based on autocorrelation functions. The properties of auto correlation and partial autocorrelation functions are used to identify the suitable model. The automation process has significantly minimized the user interaction indicating the possibility of more usage of Box-Jenkins method. The present study is the first attempt to model the real life call center data using Box-Jenkins processes with a forecasting accuracy of 10 %. The forecasted values mimic the exact pattern of the real data and each individual forecasted value match with the actual value. Keywords: Telecommunication Traffic, Box- Jenkins, and Forecasting.

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Tuesday, 13:45 – 14:45 --- Room: Mérida II & III

CONTRIBUTED SESSION: MODELING BUSINESS & ECONOMIC CYCLES II

Chair: Herman O. Stekler

PROBABILITY PREDICTIONS OF RISING VS. DECLINING REAL GDP GROWTH AND INFLATION Don Schunk*

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The importance of reliable forecasts of movements in real GDP and inflation is well understood. From monetary policymakers to private firms, key decisions are based on relatively short-term expectations of real activity and inflation. Often times, these forecasts come in the form of point forecasts (and related interval forecasts) of real GDP growth and inflation. However, these decision-makers are often concerned with short-term changes in trends of economic growth and inflation. That is, of ultimate concern may be whether GDP growth and/or inflation are on the verge of accelerating or declining, and what the associated probabilities of these outcomes are. This paper uses limited dependent variables techniques to model the probabilities that short-term real GDP growth and inflation will be either rising or falling, where the predictions are based on a variety of alternative indicators, including monetary aggregates, interest rates (alone and as spreads) and financial market indicators. This work is very much in the spirit of Estrella and Mishkin (1998) who identified the yield spread as a superior predictor of U.S. recessions. The contribution of this current research will be to analyze the probability of increasing or declining growth, as opposed to just the prediction of recession versus expansion, and to also examine which indicators are useful for predicting rising or falling inflation as well as real GDP growth.

Keywords: macroeconomic forecasts, financial variables, monetary variables, probability forecasts

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CHARACTERIZATION AND FORECAST OF TURNING POINTS IN ECONOMIC CYCLES: AN APPLICATION TO LATIN AMERICA

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This paper is split into two parts. First, we discuss the various concepts and measurement issues inherent to the characterization of the economic cycles turning points and we try to provide a datation of the turning points of Latin American countries, regions and Latin America as a whole. The dates of peaks and troughs of the growth and business cycles are estimated by using direct and indirect approaches through non parametric methods, such as the Bry and Boschan algorithm developed by the NBER, and parametric approaches mainly based on Markov-Switching processes popularized by Hamilton (1989). This dating methodology allows to evaluate the existence of a common cycle for the Latin America economies and their temporal convergence. Moreover, we assess how the frequent financial crisis arising in these countries are integrated in the classical scheme of the cyclical evolution, as described in the ABCD strategy (see Anas and Ferrara, 2002). Second, we propose to construct a probabilistic coincident or leading indicator to nowcast or to forecast the turning points of the zone by using a multivariate Markov-Switching process. For that purpose, we review some recent multivariate models and we apply some of them to a set of financial variables, opinion surveys, real production series and score functions such as reserves/import, real exchange rates and inflation. **Keywords**: economic cycles, turning points, leading indicator, Latin America

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ANALYZING THE CAUSES OF FORECAST ERRORS: LESSONS FROM THE 1930s Joel David George Washington University, jester@gwu.edu Robert Goldfarb George Washington University, gldfrb@gwu.edu Herman O. Stekler* George Washington University, hstekler@gwu.edu

This paper explores the causes of the errors of the late 1930 forecasts. The consensus was that the trough of the cycle would occur early in 1931, and 1931 would show a recovery. These forecasts were made despite the fact that the late 1930 data showed no signs of a recovery. We now know that 1931 witnessed the largest negative growth rate for the U.S. economy in any year in the 20th century. We discuss business cycle theories available in 1930, to see if empirical investigations based on these theories would have predicted a quick end to the Depression. We then explain the forecasting methods used in 1930 and we suggest features of the procedures that led to the erroneous forecasts. The lessons from this analysis of the 1930 forecasts are still applicable to present day forecasting. **Keywords**: Forecast evaluation, Great Depression

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Tuesday, 13:45 – 14:45 --- Room: Valladolid

CONTRIBUTED SESSION: MACROECONOMIC FORECASTING III

Chair: Bengt Assarsson

HOUSE PRICES AND HOUSING INVESTMENT IN SWEDEN AND THE UNITED KINGDOM. ECONOMETRIC ANALYSIS FOR THE PERIOD 1970 – 1998 Bharat Barot *

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We estimate quarterly dynamic housing demand and investment supply models for Sweden and the UK for the sample period 1970-1998, using an Error Correction Method (ECM). To facilitate comparisons of results between Sweden and the UK we model both countries identically with approximately almost the similar type of exogenous variables. The long run income elasticities for Sweden and the UK are constrained to be 1.0 respectively. The long runs semi-elasticity for interest rates are 2.1 and 0.9 for Sweden and the UK. The speed of adjustment on the demand side is 0.12 and 0.23 while on the supply side is 0.06 and 0.48 for Sweden respectively the UK. Granger causality tests indicate that income Granger causes house prices for Sweden, while for the UK there is also a feedback from house prices to income. House prices Granger cause financial wealth for Sweden, while for the UK it's vice versa. House prices for the UK and Sweden. In both countries Tobin's q Granger cause housing investment. Generally the diagnostic tests indicate that the model specifications were satisfactory to the unknown data generating process.

Keywords: House prices, Housing investment, Tobins' q, Error Correction, Co integration, Long run and elasticities, Granger- causality, forecasting ability.

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A DYNAMIC MODEL OF FORMAL AND INFORMAL AGGREGATE LABOR FORCE PARTICIPATION Rodrigo García-Verdú

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This paper develops a dynamic model of formal and informal aggregate labor supply. The model is then estimated using quarterly data from Mexico's National Urban Employment Survey (ENEU) for the period 1994.3 to 2001.1. This data set is a rotating panel similar to the U.S. Current Population Survey, which permits the non-parametric estimation of the transition probabilities of individuals between four occupational states: formal employment, informal employment, unemployment, and out-of-the labor force. In this sense, the model builds aggregate labor supply from microdata. Once the transition matrices are estimated for every consecutive quarter, they are combined with the official population projections from Mexico's National Population Council (CONAPO) to produce a forecast for the evolution of formal and informal employment in the next ten years under different scenarios for GDP growth.

Keywords: Aggregate Labor Supply, Formal and Informal Employment, Panel Data, Transition Matrix, Mexico

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THE INFORMATION CONTENT OF BARGAINED WAGES IN SWEDEN Bengt Assarsson* Monetary Policy Department, Sveriges Riksbank Bengt.Assarsson@riksbank.se Sara Tägtström Monetary Policy Department, Sveriges Riksbank Sara.Tagtstrom@riksbank.se

ing is an important determinant of wage formation. A stud wages however diverge from here

Wage bargaining is an important determinant of wage formation. Actual wages however diverge from bargained wages, the difference being defined as *wage drift*. In this paper we focus on the information content or the predictive power of wage contracts - the outcome of wage bargains in the Swedish industry. Negotiated wages are often used as predictors of actual wages. Bargained and actual wages may be determined by similar factors, such that the difference between them turns out to be small. Forecasts produced by conventional wage models, where wages *w* are determined by *x*={productivity, inflationary expectations, unemployment rate, replacement ratio, nominal rigidities}, are denoted $\hat{w}_{t+1} = \alpha \{\hat{x}_{t+1} | I_t\}$ where the forecast of *x* in t+1 is based on information available in t. Bargained wages *b*, contracted at time t-i, are then used in forecasting wages through $\hat{w}_{t+1} = \alpha \{\hat{x}_{t+1} | I_t\} + \beta \{b_{t+1} | c_{t-t}\}$, where c_{t-t} is information when contracting, i=0,...,T and T is the longest available contract period. We analyse to what extent bargained wages improve within and out-of-sample wage forecasts and to what extent this improvement depends on the contracting period i. If bargains are based on information already contained in the conventional model one should expect the improvement to be small. The empirical results indicate that including bargained wages in conventional wage equations significantly reduces forecast errors but to a lesser extent than expected. The improvement decreases with the age of the information used in bargaining.

Keywords: Wage formation, nominal wage forecast, Sweden, time series analysis, trade unions.

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• Tuesday, 15:00 – 16:20 --- Room: Yucatán III

CONTRIBUTED SESSION: EXPONENTIAL SMOOTHING

Chair: GC Karakostas

VARIATIONS ON HOLT-WINTERS' MODELS

Muhammad Akram *

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We discuss Holt-Winters' additive seasonal exponential smoothing method, and several variations of it. In each case, we derive a state space model that underlies the forecast method and study the properties of the model. We examine the invertibility space for each model, the stability of the seasonal component, and the relationships between models. Our key results are (1) that the usual Holt-Winter's method leads to the seasonal term being contaminated by the level term; (2) the usual Holt-Winters method leads to forecasts that are always non-invertible; and (3) the renormalization proposal of Roberts (1982) leads to the best model. We apply the various models to some real data to demonstrate the differences between the models in application.

Keywords: Exponential smoothing, invertibility, normalization, state space models.

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METHOD SELECTION AND FORECAST ACCURACY: THE DOG THAT DOESN'T BARK? Richard Lawton*

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Previous research on method selection (presented at a previous ISF) has shown that the AIC is a reasonably successful way to decide which of three exponential smoothing methods is most suited to a particular set of data. This work has been based on simulations, where the correct model was known, and has aimed at trying to distinguish between three models, one for which simple exponential smoothing was optimal, one for which damped Holt's method was optimal and one for which Holt's method was optimal. The AIC manages (for series of length 100) to correctly identify the correct model for around 75% of the series. Despite this, the research has not demonstrated any significant advantage for selection by the AIC when we come to look at forecast accuracy. Even worse, it can be difficult to see an advantage for those series where we know the wrong method has been chosen over those where the right method is chosen. This is especially worrying because the simulated series should offer a greater advantage to selection by the AIC than real-life series, given that the data for both the fitting and forecasting periods has been generated by a known optimal model. This paper explores this problem in an attempt to provide an explanation of this peculiar situation. **Keywords**: Method Selection, Exponential Smoothing Methods

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EXPONENTIAL SMOOTHING TECHNIQUES FOR THE SEASONAL FOOD SUPPLY CHAIN Kevin Albertson*

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Food retailers typically require frequent forecasts for large numbers of products sold at a range of locations. Further up the supply chain, food manufacturers need forecasts to drive Manufacturing Resource Planning systems and to guide materials procurement. The availability of Electronic Point of Sale Data (EPOS) means frequent and rapid forecasting is possible for specific products, brands and package sizes. The frequency and number of forecasts required by retailers and their suppliers suggest the use of exponential smoothing techniques for forecasting. The highly seasonal nature of food sales encourages use of Holt-Winter's smoothing models. Seasonality is a characteristic of a wide range of manufactured food products ranging from bakery goods and canned soups to ready-to-eat breakfast cereals. The paper draws on forecasting experience at a food manufacturer in the north-west of England using weekly EPOS data from supermarket customers to improve manufacturing planning. In this context, we assess the robustness of alternative smoothing techniques for seasonal forecasting in the food sector. We evaluate alternatives to Holt-Winter's such as damped trend, as well as non-standard techniques such as seasonal trends smoothing and periodic smoothing developed by the authors. Such techniques allow for a parsimonious and intuitively appealing representation of seasonality. We conclude with comments on the choice of an appropriate seasonal methodology in this context. **Keywords**: Holt-Winters.

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PERFORMANCE, OPTIMAL PARAMETERS AND ROBUSTNESS OF EXPONENTIAL SMOOTHING METHODS

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This paper reviews the performance of four well known methods that are used in forecasting non-seasonal demand: Single Exponential Smoothing, Holt's method, Brown's double exponential method and Gardner & McKenzie's damped trend method. In addition, a new damped trend method, based on Brown's double exponential smoothing, is evaluated. The performance of the forecasting methods is evaluated using extensive empirical datasets obtained by Syncron UK Ltd. Firstly, the optimal parameters are identified empirically, offering results on methods requiring two or more parameters, where previous evidence is scarce. Secondly, the robustness to non-optimal parameter specification is investigated. Finally, the forecasting accuracy of the methods is examined, using a wide range of accuracy measures. The results obtained offer some support for Brown's method and its extension to damped trend forecasting.

Keywords: exponential smoothing, robustness, optimal parameters, Brown

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Tuesday, 15:00 – 16:00 --- Room: Yucatán IV

CONTRIBUTED SESSION: EXCHANGE RATES

Chair: Sinézio Fernandes Maia

ARE PROFESSIONAL FOREIGN EXCHANGE RATE FORECASTS RATIONAL? EVIDENCE FROM SURVEY DATA Chuling Chen*

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The rational expectation in foreign exchange rate prediction is generally defined as: (1) the expected exchange rate is an unbiased; (2) it incorporates all of the information available. However, few empirical findings on market survey data support the two requirements. This paper tries to address the issue from another angle. Instead of focusing on the performance of professional forecasts in terms of their mean squared error, the paper argues that the way the forecasts are generated might be more important in understanding the persistent forecast errors. The paper first conducts some general unbiasedness test and cointegration tests for a monthly exchange rate survey data for 5 major currencies, Canadian Dollar, French Franc, Deutsche Mark, Japanese Yen and British Pound, from May 1984 till April 1998. Not surprisingly the rational expectation hypothesis cannot be accepted. Then the paper sets up a state space model (Kalman filter) where the true currency return process is unobserved and the observed one is composed of a persistent and a transitory part. By estimating and comparing the parameters associated with the forecasted and the actual currency return series, the paper finds that (1) the estimate of the autoregressive coefficient is similar, i.e. forecasters basically get the persistence of the series correctly; (2) forecasters tend to under estimate persistent shocks, which are related to fundamentals, and have a higher noise to signal ratio than the actual data; (3) the difference of the noise to signal ratio between actual and forecasted series is bigger at the short horizon than at the long horizon-forecasters put more weight on the signal they receive about fundamentals for long run forecasts. These findings can be used to explain why there is persistent under prediction in short run forecasts and thus rational expectation fails to hold. Keywords: rational expectation, survey, exchange forecast

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HIDDEN MARKOV MODELS FOR MODELLING THE SIGN OF THE EXCHANGE RATE (MEXICAN PESOS PER DOLLAR) Norberto Bahena-Juárez* VALMEX, México, nbahena@valmex.com.mx Juan José Fernández-Durán Departamento de Estadística, Instituto Tecnológico Autónomo de México, jfdez@itam.mx

We develop a hidden Markov model to predict the sign of the exchange rate Mexican pesos per Dollar in a daily basis. The transition matrix of the hidden Markov process is modeled as a function of different covariates. Among these covariates we include macroeconomic variables such as inflation, GNP and reference interest rates in Mexico and USA and oil price among others. The final selected model only includes the reference interest rate in Mexico (CETES) and only is significant to predict an increase in the exchange rate. Also, the final model indicates that exist periods where the sign of the exchange rate behaves as a random walk but when the reference interest rate in Mexico present extreme values then the sign of the exchange rate behaves no more as a random walk and it is possible to predict it with some success.

Keywords: Exchange Rate, Hidden Markov Models, Random Walk.

* VALMEX, México, D.F., MEXICO

Details of Sessions: Tuesday



ECONOMIC OPENING AND THE IMPACT OF THE INTEREST RATE AND OF THE RATE OF EXCHANGE ABOUT THE EXPORTS OF BRAZIL

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Brazilian industrial policies have been driven by changes in the terms of trade between agriculture and industry, which drained resources out of the agricultural sector. Brazilian agriculture has depended heavily on exports to grow, and the exchange rate has played an important role on exports. Thus, macroeconomic policies have exerted an important impact in the process of agricultural growth through exchange rate policy. During the last two decades world economy experienced important changes, specially because of the speed of the financial market integration. This new economic scenario induced changes in the structure of agriculture policies. The main reasoning of this work was the search of a model based on an open economy suitable to analyze changes on Brazilian agriculture during the period of 1980 to 2000, specially the effect of exchange rate on interest rate and agricultural exports. The theoretical approach used Mundell-Fleming model, which analyzed asset market variables on economic policies over alternative environments of exchange rate. The empirical strategy used time series models to estimate a Vector Autoregression (VAR) model with contemporary causality, taking into consideration long run relations, which can influence short run trajectory. The estimation of an error correction VAR model permit to assess agricultural exports chocks on the exchange rate and interest rate. One of the main results of this research was a significant impact of the exchange rate and interest rate on the path of agricultural exports. The empirical model provided an analysis of the speed of adjustment of the system in the periods analyzed. The agents became faster in your decisions starting from 1989. The equations of export incorporate variables, as the interest rate, altering like this the dynamics of the section. It was conclued like this, that the macroeconomics variables are fundamental for the determination of the path of the agricultural exports. Keywords: Time Series, VAR, Exports.

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Tuesday, 15:00 – 16:20 --- Room: Mérida II & III

CONTRIBUTED SESSION: UTILITIES FORECASTING

Chair: Josef Keder

OIL FIELD REVITALIZATION: TECHNOLOGY FORECASTING INFORMING BUSINESS

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The oil and gas industry has been one of the most profitable businesses on earth for over a hundred years, and has continued to be profitable despite large periodic variations in the oil price. As many of the global fields in production began to decline, interest increased in how production could be maximized from older wells/mature fields on shore and decline phases of field life. Technologies used for oil field revitalization have been allowing mature oil provinces to contribute to the global oil marketplace. Several technologies have been appointed by the literature such as hardware in completions and artificial lift, and in downhole measurements; and software to better design wells, analyze well performance, troubleshoot and ultimately optimize production from existing fields. Although heavy time commitment and costs associated with this endeavor are significant, the returns can be extremely attractive for those willing to make the investment. Evidences have been showing that many countriese recover significant amounts of oil from enhanced oil recovery process. As a relatively new Brazilian strategy for oil extraction in the last 30 years has mainly been directed to exploit resources from lower-cost areas. With the market deregulation and increasing competition in the 1990s, time has come to highlight policies devoted to make mature fields more attractive for business. The main purpose of this paper is to discuss how data mining techniques can be used as a forecasting tool for helping policymakers and "oil businessman", in Brazilian context. Using information arising from petroleum and patent data bases, information technology and statistical analysis we identified the main international players and technologies. This information, validated by expert opinion, will enable to situate the state-of-the art in the mature oil fields subject and to infer future scenarios, providing indicators for public policies for the development of Brazilian technology in this field. Keywords: Data mining – Technology development – Mature oil fields – Oil revitalization – Brazilian Oil Province

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IMPACT OF HUMAN BEHAVIOUR ON ENERGY CONSUMPTION ON THE NATIONAL GRID TRANSMISSION SYSTEM Shanti Majithia*

In England and Wales the demand for electricity during a popular television programme is depressed and it rises sharply at the end of a programme. Although this phenomena has been observed for sometime managing and minimising these risks is becoming vital in balancing of Generation and Demand of Electricity. Some recent examples and use of scenario forecasting methods will be discussed. The report will then go on to discuss the forecasting performance and will also examine the correlation with the audience statistics. The paper will attempt to explore if similar sort of effect in other countries has been observed.

Keywords: Demand for electricity.

* UK



GAS CONSUMPTION FORECAST AND RISK MANAGEMENT

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There is no need to emphasize strongly the economical aspect of energy consumption forecasting in current conditions of price formation for natural gas distribution companies. Knowledge of the future maximal values of a natural gas load over a week or a month horizon is very important for dispatchers in power distribution companies, who use this information for operating and planning. In our contribution we discuss a possibility to connect the gas consumption prediction module with a risk management module. The distribution function of prediction errors is estimated and probability P (load > threshold) is derived. The optimal selection of possible regulations of individual consumers is performed by maximizing of the economical profit or minimizing of the company loss. The number of possible combination is very large and we use genetic algorithms (GA). The results from two examples are shown: the optimal regulation design (minimal loss) and the optimal gas selling strategy design (maximal profit). **Keywords:** natural gas consumption prediction, risk management, genetic algorithms

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POWER SUPPLY NETWORK OUTAGE MANAGEMENT BASED ON METOROLOGICAL FORECAST

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It is a paradox of the modern civilization that its sensitivity to the weather phenomena increases with the level of its technical advancement. Sensitivity of the power supply networks to strong winds, lightning discharges and icing may serve as an example. There is no doubt that economical loss caused by the mentioned phenomena can reach a considerable amount. Therefore, there is a great interest of the power-distribution companies to minimize their loss by using a sophisticated forecasting system, which enables us to predict dangerous weather events with a reasonable performance. For this purpose the prediction system "MEDARD", based on mesoscale and microscale numerical weather prediction model MM5 has been developed. Two prediction algorithms have been implemented: one for the prediction of storms with cloud-to-ground lightning occurrence, another one for icing rise. As a final step, an outage risk index was designed, which is evaluated and displayed in an user-friendly graphical form. The output is used by dispatchers responsible for the network control and in-time planning of restoring capacities. The first version of the system together with examples of real situations is presented.

Keywords: numerical weather prediction, decision support systems, risk assessment

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Tuesday, 15:00 – 16:20 --- Room: Valladolid

ORGANIZED SESSION: FORECASTING WITH GENERALIZED LINEAR MODELS

Organizer and Chair: Wilfredo Palma

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PREDICTION AND REGRESSION WITH TIME SERIES OF OBSERVATIONS FROM EXPONENTIAL FAMILY DISTRIBUTIONS Leonardo Epstein * Pontificia Universidad Católica de Chile, epstein@mat.puc.cl Wilfredo Palma Pontificia Universidad Católica de Chile, wilfredo@mat.puc.cl

William Checkley Bloomberg School of Public Health, The Johns Hopkins University, wcheckle@jhsph.edu

Our talk proposes a new approach to model time series of observations from exponential family distributions. The approach builds two-stage models where the first stage is a conditional model from the exponential family. The second stage is a normal ARFIMA process that models the temporal correlation of the observations. We provide results that allow one to identify the second-stage ARFIMA process in a manner similar to identification of Gaussian stationary ARFIMA models. We provide further results for non-stationary processes and discuss the use of generalized linear models to estimate their trend. Applications include the analysis of daily admissions for diarrhea to an oral rehydration unit in Lima, Peru.

Keywords: ARFIMA, non-Gaussian time series, generalized linear models, autocorrelation, Poisson count processes.

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STATISTICAL ANALYSIS FOR ARFIMA REGRESSION MODELS

Pilar Iglesias* Pontificia Universidad Católica de Chile, pliz@mat.puc.cl Wilfredo Palma Pontificia Universidad Católica de Chile, wilfredo@mat.puc.cl.

This paper discusses statistical methodologies to analyze the problem of air pollution in Santiago, Chile. These time series regression data display long memory behavior. Thus, a generalizaed linear regression model is proposed with ARFIMA errors. This study presents both classical and Bayesian approaches. **Keywords**: ARFIMA, Bayesian analysis, long memory, regression models.

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ESTIMATING SEASONAL LONG MEMORY MODELS Wilfredo Palma * Pontificia Universidad Católica de Chile, wilfredo@mat.puc.cl Ngai Hang Chan The Chinese University of Hong Kong, nhchan@stapc123.sta.cuhk.edu.hk

This paper studies asymptotic properties of the exact maximum likelihood estimates for a general class of Gaussian seasonal long-range dependent processes. This class includes the commonly used Gegenbauer and seasonal autoregressive fractionally integrated moving average processes. By means of an approximation of the spectral density, the exact maximum likelihood estimates of this class are shown to be consistent, asymptotically normal and efficient. Finite sample performance of these estimates is examined by Monte Carlo simulations and it is shown that the estimates behave very well even for moderate sample sizes. The estimation methodology is illustrated by a real-life Internet traffic example.

Keywords: Consistency, efficiency, strong dependency, MLE.

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ANALYSIS OF CHANGE POINT PROBLEMS USING PRODUCT PARTITION MODEL: AN APPLICATION TO LATIN AMERICA EMERGING MARKETS

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The product partition model (PPM) defined by Hartigan (1990) is a powerful tool to analyze change point problems. The PPM introduces more flexibility in the analysis of change point problems since the number of change points is a random variable and do not a fix number as considered in the most model used to approach this kind of problems. We review the PPM introduced by Barry and Hartigan (1992, 1993) and some of its extensions proposed by Loschi, Iglesias and Arellano (1999) and Loschi and Cruz (2002). The PPM is applied to identify multiple change points in normal means and variances assuming Yao's cohesions. We analyze the stock markets indexes from Argentina, Brazil, Chile and Mexico. We provide the product estimates for the expected return and the volatility in each instant, the posterior distributions of the number of change points and for the probability of having a change and also the posterior probability of each instant be a change point.

Keywords: Posterior relevances, Yao's cohesions, Normal -Inverted-Gamma distribution, Gibbs sampling.

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Tuesday, 15:00 - 16:20 --- Room: Mérida I

CONTRIBUTED SESSION: STATISTICAL METHODS III

Chair: Pilar Poncela

PREDICTION UNDER TRUNCATED MODELS

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Stochastic frontier analysis (SFA) has been developed in Marketing to characterize top performing units. A useful empirical model in SFA treats a logged response as a linear combination of logged explanatory variables plus a stochastic term measuring inefficiencies of the decision-making units. Common models for the inefficiencies include Half-Normal, Gamma and Exponential distributions. We adopt a missing data approach to model performance and pose the frontier analysis problem as a regression problem with a truncated-normal distribution. We explore the forecasting problems for this model.

Keywords: Stochastic frontier analysis, forecast, truncated normal model, skew normal model.

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A CLOSER LOOK AT THE LSTAR(1) ESTIMATION

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The Smooth Transition Autoregressive model (Granger & Teräsvirta, 1993) is an important alternative for nonlinear time series modelling. The main idea behind this model is that there are two regimes in the time series data generating process and a smooth transition between them. A common practice when estimating the parameters of this model is to concentrate the log-likelihood function on the so-called nonlinear parameters. Due to its highly flat behaviour in some regions of the parameters space, this function deserves a carefull look before implementing an estimation algorithm. By focusing on the logistic function as the one which governs the transition between the regimes and through Monte Carlo simulations, we present interesting aspects of the concentrated log-likelihood function, specially in situations when there are few points in one of the regimes.

Keywords: nonlinear models, smooth transition, logistic function

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PROPERTIES OF THE SAMPLE AUTOCORRELATIONS OF NON-LINEAR TRANSFORMATIONS IN LONG-MEMORY STOCHASTIC VOLATILITY MODELS

Ana Pérez

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The autocorrelations of log-squared, squared and absolute financial returns are often used to infer the dynamic properties of the underlying volatility. This paper shows that, in the context of Long Memory Stochastic Volatility models, these autocorrelations are smaller than the autocorrelations of the log-volatility and so is the rate of decay for squared and absolute returns. Furthermore, the corresponding sample autocorrelations could have severe negative biases, making the identification and prediction of conditional heteroscedasticity and long memory a difficult task. Finally, we show that the power of some popular tests for homoscedasticity is larger when they are applied to absolute returns.

Keywords: Box-Ljung test, Conditional heteroscedasticity, log-squared transformation, Peña-Rodriguez test, squared observations.

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THE EFFECTS OF DISAGGREGATION ON NONSTATIONARY I(1) TIME SERIES Pilar Poncela*

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This paper focuses on the effects of disaggregation on forecast accuracy for nonstationary time series using unobserved component models. Both cases, unrelated and common trends are considered for I(1) processes. Although the basic theoretical results are known for stationary vector ARMA time series, the possibility of cointegration, or equivalently the presence of common trends, brings a new dimension to this problem. The usage of unobserved component models allows the possibility of explicitly modeling the common trends. The results are applied to several macroeconomic time series and its aggregate. In this work we study the presence of common trends among several components using a multivariate dynamic factor model. We also analyze if the common information can help in forecasting the aggregate. Alternatively, if the dissimilarities among the components are quite strong, a disaggregated approach will be preferred. **Keywords**: aggregation, common trends, factor analysis, forecast.

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Tuesday, 16:20 – 17:20 --- Room: Club de Industriales

Poster Session

Chair: Viridiana Lourdes

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FORECASTING INDUSTRIAL PRODUCTION WITH LINEAR, NON-LINEAR, AND STRUCTURAL BREAKS MODELS. Boriss Siliverstovs* DIW Berlin, bsiliverstovs@diw.de Dick van Dijk Econometric Institute, Erasmus University Rotterdam, djvandijk@few.eur.nl

We compare the forecasting performance of a linear autoregressive (AR) model, a model with structural breaks, a selfexciting threshold autoregressive (SETAR) model, and two Markov-switching autoregressive (MS--AR) models (denoted as MSIAH and MSMH) in terms of point-, interval-, and density forecasts for monthly growth rates of industrial production indices of the G-7 countries, for the period 1960.1 - 2000.12. We find that the linear AR and nonlinear MSMH (popularly referred to as the "Hamilton") model are the best performing ones in terms of point forecast accuracy, whereas the structural change model and the non-linear MSIAH model are the worst performing ones. Forecast encompassing tests suggest that the point forecasts of the AR and MSMH models encompass the forecasts of the other models more often than the opposite occurs. In terms of interval forecasts, we find that the MSMH model offers superior performance over the rest of the models, including the linear AR model. Finally, upon evaluation of forecast densities we find that the MSIAH model performs worse than the rest of the models. At the same time we do not find any systematic pattern that would allow us to select the best performing model in terms of density forecasts. **Keywords**: Industrial production, Interval Forecasts, Density Forecasts, Nonlinearity, Structural change.

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IDENTIFICATION OF A TRANSFER FUNCTION MODEL THROUGH THE GENERALIZED EXTENDED SAMPLE AUTOCORRELATION FUNCTION: THE OVERFITTING PROBLEM Cristina Oliveira

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In practice, in a $(r,s,b)\times(p,q)$ bivariate transfer function model identification, the value orders r and s related, respectively, to the output and the input polynomials are unknown and its specification through the generalized extended sample autocorrelation function (Oliveira, C. e Müller, D., 2001) depends directly on consistent iterated least-squares estimators produced by iterated multiple linear regressions. However, the use of this model identification procedure can lead, for the series under study, to a model for which the output and the input polynomial orders are greater than the true orders r and s. This is referred to as the overfitting problem. In this work, based on the iterated least-squares estimators properties and consistency conditions, we present a particular case of the overfitting problem in the generalized extended sample autocorrelation function ambit.

Keywords: bivariate transfer function model, iterated least-squares estimators, generalized extended sample autocorrelation function.

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DISCRIMINATING TREND STATIONARITY FROM LONG RANGE DEPENDENCE BY MEANS OF THE FORECAST ENCOMPASSING PRINCIPLE

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Empirically, it is difficult to offer unequivocal judgment as to whether many real economic variables are long-range dependent or trend stationary. One possibility is to discriminate between these two non-nested models by means of the forecast encompassing principle. In this paper we propose a local version in the frequency domain of the *t*-Student test. After conveniently adjusting variance estimates, this *t*-ratio has a well-defined (nonstandard) asymptotic distribution leading to a consistent model selection procedure.

Keywords: Trend stationarity, long range dependence, forecast encompassing, frequency domain.

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FORECASTING OF FINANCIAL TIME SERIES USING NON-LINEAR METHODS

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We present the results of several forecasting experiments of daily financial time series, namely the one-day interest rate in Mexico and the peso/dollar exchange rate. We use nonlinear methods, such as GARCH models, TAR models and neural networks and compare results. We also compare the returns of an investment strategy based on these forecasts with the returns obtained by existing mutual funds of comparable risk, in order to better asses if our models are able to beat the market.

Keywords: GARCH, TAR models, Neural Networks, forecasting.

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CLASSIFICATION OF STATIONARY AND NONSTATIONARY TIME SERIES Jorge Caiado*

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The problem of identifying similarities or distances in time series data has been extensively studied in the discrimination and clustering literature. However, many studies use only nonparametric approaches for splitting a set of time series into some clusters by looking at their Euclidean distances in the space of points. There are few studies involving parametric methods. In this paper, we study a measure of distance based in the autocorrelation coefficients following an idea of Galeano and Peña and provide simulation results comparing this measure with the one of Piccolo. In particular, we discuss the classification of time series as stationary or nonstationary.

Keywords: Autocorrelation function, ARIMA models, Classification, Distance measure, Stationary and nonstationary time series.

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FORECASTING LENGTH OF STAY IN HOSPITAL FROM NUTRITIONAL INFORMATION Janice O'Connor

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In our study a regression model was used to determine whether nutritional status has an impact on length of stay of children in a tertiary pediatric hospital. Initial nutritional assessment of hospitalized children involves measurement of height and weight and plotting these measurements on growth charts. From these data, the nutritional status of children can be determined: normally nourished, under-nourished or over-nourished (overweight or obese). In our study, measurements of height and weight were collected for 189 inpatients (54% male) aged 2-18 years. The Management Support and Analysis Unit of the hospital supplied data for each patient on length of stay in hospital for that admission. Five percent of patients were under-nourished. However, 22% of patients were overweight or obese. In a regression model to predict length of stay in hospital, nutritional status (P=0.004) and the interaction between age and nutritional status (P=0.009) were significant predictors. For overweight/obese patients, length of stay increased significantly with age. For normally-nourished and under-nourished patients, length of stay was relatively constant, regardless of age. Our study shows that nutritional information obtained from simple measurement of height and weight can be used to forecast length of stay in hospital. The high prevalence of overweight/obesity in hospitalized children, and the increased length of stay for older over-nourished patients, have important financial implications for hospitals. **Keywords**: Forecasting, Medical Applications, Regression Model.

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IMPROVING TECHNICAL FORECASTS OF THE MEXICAN STOCK MARKET WITH NEURAL NETWORKS Mayra A. Balcázar Pérez * ITAM, balcazar@itam.mx Alfonso Camacho Bustillo* Comisión Nacional Bancaria y de Valores, acamacho@cnbv.gob.mx Francisco Cervantes Departamento de Computación, ITAM, cervante@itam.mx Martin K. Hess*

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In this paper, we present a neural network approach, based on technical analysis indicators solved with a Bayesian regularization training, to predict the behavior of the Mexican stock market. The results show a substantial improvement of return predictability as compared to conventional forecasting models. Moreover, at a medium term horizon, simulations of active portfolio management strategies generate consistently abnormal profits net of transaction costs. The results are robust to different model setups. Our method proves to be particularly valuable for an emerging economy exhibiting a high degree of market frictions. Such circumstances enhance the value of a learning mechanism in the prediction model relative to static optimization procedures as recurring stock price patterns tend to be very distinct.

Keywords: Forecasting, Neural Networks, Bayesian Regularization, Technical Analysis, Stock Market.

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JUDGMENTAL FORECASTING WITH THE ANALYTICAL HIERARCHY PROCESS: A FORECASTING APPLICATION FOR NEW PRODUCT MARKETS

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In this paper we explore a methodology for the forecasting process of New Product Markets. The lack of past information on this type of markets, as well as the fact that other countries' experiences are not fully comparable with local markets, suggest that the time series forecasting or other statistical approaches have little or no applicability on the forecasting process of New Product Markets. This situation highlights the need for a method for improving judgmental forecasting activities. We present such a methodology. It is based on the well-known Analytical Hierarchy Process (AHP) developed by Thomas Saaty. The benefits obtained by applying this method are: it can improve judgmental forecasting via its consistency; it is fully replicable, which is a desirable property of judgmental forecasting systems; the AHP generates an assessment of priorities for the factors that will affect the forecasting variable, this is already a useful outcome that increases our knowledge of the New product Markets; also, several experts' judgment can be compared and included in the forecast. In the first section we summarise the findings on judgmental forecasting approaches as tools that are alternatively available to statistical approaches along with its benefits and lacks. Next, we describe the AHP methodology applied on the forecasting process, specifically we utilised the AHP in order to systematically generate different scenarios developed by experts and their respective next year forecast for the Handhelds market in Mexico. We highlight the differences between our use of the AHP and that of Saaty's. Finally, we highlight the need of combining the judgmental forecasting approaches along with time series and statistical analysis in order to improve accuracy of the forecasting activity, when available information makes it possible. Keywords: Analytical hierarchy process, Judgmental forecasting, New product markets.

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NONPARAMETRIC TESTS FOR LINEAR PREDICTORS IN GLM José A. Cristóbal*

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Generalized Linear Models (GLM) have become a very appreciated tool in the context of statistical modelling, since they allow us to obtain a relationship between data and the main parameters in a general way through the link function. But it is important to determine if the choice of the link is appropriate, and even, if under this link the linear hypothesis is suitable. Sometimes, data are affected by length bias, so that the more is the value of the variable, the higher the probability of it being recorded. Cristóbal and Alcalá (2000) have obtained nonparametric estimators of the regression function in this context. When the data are observed in this way, the problem of the lack of specificity in the model can become crucial, since the interest variable is not directly observed. In this work we propose some fit-tests based on the supreme and quadratic norm. In order to obtain consistently estimators of the linear predictor, the solutions will be constructed by way of local polynomial fitting (Fan and Gijbels, 1996). Unfortunately, in the context of length biased data, it is not possible to directly use the equation of usual estimation, and we propose other one, based on the bias compensation by means of the reciprocal of the response variable in each term of the log–likelihood (Vardi, 1985). **Keywords**: Generalized linear models, Length biased data, Local polynomial fitting.

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CLEAN CARS SALES TRENDS USING THE BASS MODEL Rogerio Domenge* Departamento de Administración, ITAM, domenge@itam.mx

Current and future limited fosil fuel supply problems, fluctuating oil costs and associated risks, and high levels of city pollution have been some of the main triggers in new technology development for alternative transport vehicles. Some of these main new vehicle technologies are alcohol, electricity, natural gas and hydrogen. As in any new technology or new product launch, it is desirable to estimate the future sales trends in order to make technology, product, manufacturing and marketing investment decisions. This research presents the application of the Bass model to estimate the sales trends for some new selected new clean car fuel technologies. The coefficient of innovation, the coefficient of imitation, the market potential and the time of the peak sales are calculated for each of them, and, as a historical reference, these parameters are also estimated for historic Ford T production figures. **Keywords**: Clean cars, technology, Bass model, new product trends.

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HOLT-WINTERS METHOD IN DIFFERENT SOFTWARE

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When using the Holt-Winters method, the smoothing parameter estimation gives different results depending on the statistical software employed. We carried out this investigation to compare the results obtained with different statistical packages. It will also show the advantages and disadvantages in each software. **Keywords**: Smoothing methods, Holt-Winters method.

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COMPARING FORECAST INTERVALS IN ARCH-M MODELS: AN APPLICATION TO THE SPANISH STOCK MARKET

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This paper presents a statistical comparison of forecast intervals in ARCH-M models between a parametric approach, on the one hand, and when a bootstrap method is used, on the other. First, we present the forecast intervals correcting pth quantil of the s-step-ahead conditional distribution by means of Cornish-Fisher expansion. This method has been proposed by Miguel and Olave (2002) in ARMA process with GARCH(1,1) innovations that allow for the conditional variance to be a regressor variable in the conditional mean. This hypotheses is usual in the studies of the risk premium in an efficient capital markets. The forecast error has a distribution that depends nontrivially on the information set and, therefore, the classical forecast intervals do not work well [Olave, Salvador and Muñoz (2000)]. As an alternative, we propose a bootstrap method [Miguel and Olave (1999)] to approximate the distribution of the future values by means of resampling the standarised residuals. The pth quantil of the s-step-ahead forecast error distribution is approach using the Monte Carlo method. Finally, both forecast methods are applied to an analysis of the Spanish Stock Market. The proposed bootstrap method improve the accuracy of the confidence intervals for financial time series. We find that when volatility is a determining factor in the risk premium the forecast errors exhibit skewness and excess kurtosis, and we suggest the proposed bootstrap procedure to deal with this problem.

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OPTIMAL PROSPECTIVE TRADING RULES

David Bock*

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In the finance literature and among practitioners, there are several suggested prospective decision rules, sometimes referred to as technical trading rules, which aim at online detection of a turning point in e.g. the price level of assets. In statistical surveillance, which deals with the theory and methodology of continual observation of time series in order to quickly detect a change in the underlying stochastic process, optimal properties of methods has been investigated extensively. The aim here is to investigate the optimal properties of some of the proposed trading rules by relating them to methods of statistical surveillance. The trading rules considered here are the Filter rule and rules based on moving averages. The results show that the rules, in certain cases, do fulfill certain optimality criteria. Further, the purpose is to enhance the use of proper evaluation, where the measure of timeliness of the alarm is considered. It is shown that the return on investments can sometimes be related to timeliness measures. A new non-parametric and robust approach never used in financial settings is proposed. The methods are evaluated on Hang Seng Index. **Keywords**: Turning point, Statistical process control, Trading rules, CUSUM, Moving average.

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Details of Sessions: Wednesday

Details of Sessions: Wednesday

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Session Chairs:

Please notice that session chairs for contributed paper sessions were picked as the last speaker of the session. This is the usual procedure in these meetings. We thank you for your cooperation.

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Wednesday, 9:50 – 11:10 --- Room: Yucatán III

ORGANIZED SESSION: NONLINEAR DYNAMIC MODELS

Organizers: Víctor Aguirre and Graciela González Chair: Víctor Aguirre Statistics Department, ITAM, aguirre@itam.mx

> A BAYESIAN APPROACH TO EMM A. Ronald Gallant* Fuqua School of Business, Duke University, ron.gallant@duke.edu Robert E. McCulloch Graduate School of Business, University of Chicago.

The standard implementation of efficient method of moments (EMM) estimation consists of two steps. In the first, quasi maximum likelihood is used to estimate an auxiliary model that is so richly parameterized that a very low bias fit results. In the second step, a parsimoniously parameterized model is fit by method of moments (more precisely, by minimum chi-squared) using the score of the auxiliary model as the moments to be matched. Because the expectation of any function can be computed by simulation, this method is frequently used to estimate a model whose likelihood has no known closed form solution but which is easily simulated. For example, the method is often used to estimate a continuous time stochastic volatility model from financial market data. This same notion of using a richly parameterized model can be employed within a Bayesian setting. The method can be implemented completely by simulation, using MCMC methods for parameters, as is commonly employed within the Bayesian paradigm, and simulation of data from the parsimonious model to provide the match to the auxiliary model. The paper describes the details using a general equilibrium model from economics for illustration.

Keywords: Bayesian, Dynamic models, Markov Chain Monte Carlo.

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EMM UNDER MODEL MISSPECIFICATION Víctor Aguirre Torres* Statistics Department, ITAM, aguirre@itam.mx Manuel Domínguez Toribio Statistics Department, ITAM, madt@itam.mx

The Efficient Method of Moments (EMM) is a procedure for fitting the parameters of complex stochastic models that appear in science; the complexity of these models is such that their parameters are not amenable to be estimated directly by maximum likelihood. Instead, EMM uses the scores of an auxiliary model to generate moment constraints. The use of EMM is convenient when it is easy to simulate from the model of interest. The paper presents the asymptotic theory of EMM when the model of interest is not correctly specified. The paper assumes a sequence of i.i.d. observations and a global misspecification. It is found that the limiting distribution of the estimator is still asymptotically normal, but it suffers a strong impact in the covariance matrix. It is shown that this matrix depends on the joint covariance of both the estimator of the parameter and the information matrix from the auxiliary model. The same thing happens in the large sample distribution of these covariance matrices even in the presence of misspecification. Special attention is given to the situation when the moment conditions hold but the model is misspecified. As an alternative it is proposed the use of bootstrap to draw inferences under misspecification. It is proved that the bootstrap distributions converge strongly to the above mentioned distributions.

Keywords: Global misspecification, overidentifiying restrictions test, bootstrapping EMM.

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A SIMEX BASED UNIT ROOT TESTS IN STOCHASTIC VOLATILITY MODELS

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The Stochastic Volatility Model (SVM) has emerged as a popular alternative to ARCH / GARCH models to analyze economic time series. In SVM, the observed series r_t is modeled as the product of an unobserved variance component and an independent error component. The unobserved volatility process is in turn modeled as an autoregressive process. We can test for a unit root in the volatility process by testing for a unit root in the log-squared of the observed process, $log(r_t)$. Standard unit root tests performed on $log(r_t)$ suffer from severe size distortions due to the presence of large negative moving average root in its autoregressive moving average representation. Cook and Stefanski(1994) developed the Simulation-Extrapolation(SIMEX) procedure as a simulation-based method of estimating and reducing bias due to measurement error in nonstandard generalized linear measurement error models. We propose to apply the SIMEX method to standard unit root tests based on ordinary least squares, weighted symmetric estimators and instrumental variables to correct the size distortion and still obtain sufficient power. Examples and extension to other processes will also be presented.

Keywords: Simulation Extrapolation, ARIMA models, Dickey-Fuller Tests.

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A WAY TO PREDICT WITH THRESHOLD AUTOREGRESSIVE MODELS

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Nonlinear Time Series Models are recently becoming very popular, specially Threshold Autoregressive models (TAR). One of the drawbacks of all the nonlinear models is the difficulty on using them for prediction purposes. In this paper by considering Bayesian analysis of TAR models, the threshold parameter can be estimated with Metropolis-Hastings step conditional methods, delaying the parameter and by integrating out the remaining parameters. We determine the predictive density in order to obtain the k-step ahead prediction. We applied this method to Threshold Autoregressive Unit Root Models (TARUR) proposed by González and Gonzalo (1998). Finally, we illustrate our methodology with an application to interest rates and compared the predictions generated by different alternative methods. **Keywords:** Threshold Autoregressive Models, Metropolis-Hasting, Threshold Autoregressive Unit Root Models.

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Wednesday, 9:50 – 10:50 --- Room: Yucatán IV

CONTRIBUTED SESSION: STATE SPACE MODELS

Chair: Keith Ord

RECONSTRUCTING THE KALMAN FILTER FOR STATIONARY AND NON STATIONARY TIME SERIES

Ralph D. Snyder*

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A Kalman filter, suitable for application to a stationary or a non-stationary time series, is proposed. It works on time series with missing values. It can be used on seasonal time series where the associated state space model may not satisfy the traditional observability condition. A new concept, called an 'extended normal random vector', is introduced and used throughout the paper to simplify the specification of the Kalman filter. It is an aggregate of means, variances, covariances and other information needed to define the state of a system at a given point in time. By working with this aggregate, the algorithm is specified without direct recourse to those relatively complex formulae for calculating associated means and variances, normally found in traditional expositions of the Kalman filter. A computer implementation of the algorithm is also described where the extended normal random vector is treated as an object; the operations of addition, subtraction and multiplication are overloaded to work on instances of this object; and a form of statistical conditioning is implemented as an operator.

Keywords: Time series analysis, forecasting, Kalman filter, state space models, object-oriented programming.

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MODELLING MALAYSIAN RATE OF INFLATION USING THE KALMAN FILTER TECHNIQUE

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Ever since the pioneering work of Box and Jenkins (1977), Autoregressive Integrated Moving Average (ARIMA) has been widely used as time series modeling technique. The technique has since become the benchmark for other time series technique, including Autoregressive Conditional Heteroscedaticity (ARCH) and Threshold Autoregressive (TAR) among others. Kalman filter technique which was developed by Kalman (1960) has played a big role in the space programme and has become a necessary tool of many analyses in communication and control engineering. However, application of the technique in other areas including statistics and economics has been much slower. This paper makes use of the Kalman filtering techniques to analyse state-space model of the Malaysian rate of inflation. Comparisons of results between the ARIMA and the proposed Kalman filter models are made. The results show that, for forecasting purposes, the Kalman filter model produces smaller out-of-sample long-term forecasting error and therefore smaller confidence interval than the ARIMA model. In addition, as a measure of fit, within-sample sum of squares errors calculated from the Kalman filter model suggests that although the values are not significantly smaller than that of ARIMA model, the values show reasonable improvements over the ARIMA model.

Keywords: ARIMA, Kalman filter, prediction error decomposition, forecasting error

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THE SINGLE SOURCE OF ERROR SPECIFICATION FOR STATE SPACE MODELS: AN APPRAISAL Mark Leeds Tiedemann Investment Group, New York, m.leeds@gte.net Keith Ord * McDonough School of Business, Georgetown University, ordk@georgetown.edu Anne Koehler Department of Decision Sciences and MIS, Miami University, Ohio, koehleab@muohio.edu

We develop the properties of the single source of error (SSOE) state space models and compare these with the more common multiple source of error (MSOE) scheme. In particular, we show that the SSOE system has a parameter space that matches that of the corresponding ARIMA system, and is always larger than the parameter space of the corresponding MSOE scheme. Several properties of state space models, such as equivalence, are dealt with more simply in the SSOE framework. The state variables in the SSOE version converge to their true values as the sample size increases, a property not shared by MSOE. In turn, this property makes it straightforward to integrate classical exponential smoothing methods into the state space framework and to generate predictive distributions for these useful, if ad-hoc forecasting methods. Smoothing procedures take on a somewhat different complexion in the SSOE format, using interpolation rather than fitted values. The performance of the SSOE and MSOE schemes is compared using both simulated and real series to illustrate their strengths and weaknesses. The paper concludes with a number of suggestions for further research.

Keywords: ARIMA, dynamic linear models, exponential smoothing, sources of error.

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Wednesday, 9:50 – 10:50 --- Room: Mérida II & III

CONTRIBUTED SESSION: JUDGEMENTAL FORECASTING III

Chair: Roy Batchelor

THE IMPACT OF INSTITUTIONAL CHANGE ON FORECAST ACCURACY: A CASE STUDY OF BUDGET FORECASTING IN WASHINGTON STATE Elaine Deschamps*

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In the state budget process, lawmakers and budget writers rely on the accuracy of revenue and expenditure forecasts. The expenditure forecasting process is driven by caseload projections of the demand for services such as Medicaid, foster care, long-term care for the elderly and disabled, and public education. This paper analyzes the development of the caseload forecasting process in Washington State. In 1997 the Caseload Forecast Council (CFC) was created by the legislature as an independent agency responsible for the production of statewide caseload forecasts. This paper examines the role of the CFC as a driver of institutional change and its impact on forecast accuracy. It applies a number of hypotheses from the politics of forecasting and state revenue forecasting literature to the caseload forecasts produced before and after the creation of the CFC. Specifically, it tests the hypotheses that the creation of the CFC led to improved forecast accuracy, improvements in accuracy occurred gradually over time, and forecast accuracy was improved by factors such as more frequent revisions, the technical workgroup, and program knowledge. This research found that forecast accuracy did gradually improve over time after the CFC was created, and that more frequent revisions, the technical workgroup, and program knowledge all contributed to improved forecast accuracy.

Keywords: forecast accuracy, judgmental forecasting, government forecasting, politics of forecasting

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IMPLEMENTING DELPHI APPROACH TO FORECASTING OF SALES – THE EXPERIENCE OF MALAYSIAN ENTERPRISES

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Forecasts based on a group of forecasts are better than forecasts of single forecasters, particularly where no formal forecasting process exists. Delphi is one of the judgemental models where forecast is based on the input received from various experts in the area. This paper discussed the result of a study conducted among electronic enterprises in Malaysia to evaluate the forecasts to determine whether Delphi generated forecasts provide better forecast number than those generated by individual forecaster. The companies are fairly large, with number of employees varying from anywhere from 2000 to 3500. In carrying out Delphi approach, a coordinator was appointed to ensure the points provided by the panellist made are clearly captured. The interview procedure was a structured interview with anyone in the company affiliated with sales forecasting. A structured interview format was chosen to ensure that there was no miscomprehension of questions and information. The interviewees in this study were basically people in companies who are in the forefront of forecasting. Only managers with experience in their jobs were interviewed as this was felt to be important for obtaining accurate and informed responses. These managers were chosen because their direct involvement in their companies' method of generating forecasts and it was thought that, because of their position, they would be able to give informed responses about their organisations' forecasting process.

Keywords: Forecasting, Delphi Method, Expert Opinion, Electronic Industries and Judgmental Forecasting

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WHY ARE PROFITABLE TRADERS PROFITABLE? EVIDENCE FROM TECHNICAL TRADERS IN BOND FUTURES MARKETS. Roy Batchelor*

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This paper examines the sources of profits made by trades publicly recommended by a set of bond market forecasters. The forecasts are based on technical analysis, the judgmental interpretation of charts of price-based indicators. This is the most popular short term forecasting method used in financial markets. However, it has a poor reputation in academia because information on technical forecasts is hard to obtain, simulations of simple technical rules typically yield no excess profits, and the more subjective methods are not replicable. We exploit a large and unique database of intraday forecasts and commentary published by analysts on a leading global financial information service. In addition to directional predictions, the data includes trading positions in futures markets taken by the analysts as prices evolve through the day. Our findings are: the trades recommended by the analysts are profitable, even adjusting for conventional risk measures such as volatility and drawdown, and when compared to the bootstrap distribution based on the same set of trading positions; the profits are higher and more consistent than those achieved by mechanical technical rules (moving average rules, filter rules) applied to hourly prices. About half of the difference is due to the traders taking advantage of favourable intra-hour prices, but there remains a significant advantage of actual over synthetic trading rules. It is difficult to replicate the actions of the traders, even with knowledge of the technical rules that they claim to be using, and even employing nonlinear (neural-network based) decision rules. Successful technical analysts appear to use indicators in a complex way. Academic tests of technical analysis based on closing prices (or even hourly prices) and on mechanical trading rules (even complicated rules) are unlikely to replicate analyst behaviour, and do not constitute a fair test of the value of technical analysis.

Keywords: Forecasting; Technical Analysis; Futures Market; Judgment; Expert System

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Wednesday, 9:50 – 11:10 --- Room: Valladolid

ORGANIZED SESSION: SIGNAL EXTRACTION: BOUNDARY PROBLEM, METHODS, DYNAMICS AND TESTS

Organizer and Chair: Marc Wildi

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GENERALIZATIONS OF THE BOX-JENKINS AIRLINE MODEL

David Findley* Census Bureau, Washington, USA, david.f.findley@census.gov Kellie Wills Census Bureau, Washington, USA John Aston Census Bureau, Washington, USA Donald Martin Census Bureau, Washington, USA

The Box-Jenkins "airline" model is the most widely used ARIMA model for monthly and quarterly seasonal economic time series. However, its "seasonal" moving average factor models both seasonal and nonseasonal components, making its coefficient perform two different tasks. We present analyses of the forecast and model-basted seasonal adjustment properties of several three- and four-coefficient generalizations of this model that we have developed. The new models provide more flexible modeling of seasonal and nonseasonal components of the time series. We make comparisons with the airline model's properties for U.S. Census Bureau series for which AIC prefers one of the new models over the airline model.

Keywords: generalized airline model, seasonal and nonseasonal components, AIC.

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NOWCASTS AND SEASONAL ADJUSTMENTS Michael Graff Swiss Institute for Business Cycle Research, graff@kof.gess.ethz.ch Bernd Schips* Swiss Institute for Business Cycle Research, schips@kof.gess.ethz.ch

A fundamental issue for policy oriented business cycle research is to generate and analyse reliable indicators of economic activity. While it is generally accepted that, since the future lies ahead, leading indicators cannot be absolutely exact, coincident indicators, which are used to derive so-called nowcasts, suffer from some of the same technical problems. The reason is that practically all indicators that can be used for nowcasts, qualitative or quanitative, are affected by seasonal patterns and have to be filtered accordingly, and this inevitably leads to boundary problems. Asymmetric filters make current data points due to future revisions by construction. Nonwithstanding other claims, this problem is not solved by methods which rely on a time series model of the data generating process to forecast some future data points, so that a symmetric filter can be applied. The reason is that the forecasts themselves cannot be absolutely exact (see above), which amounts to the fact that technically symmetric filters are applied to filter inherently asymmetric time series (observed left until the current data point vs. predicted thereafter). An alternative is to refer to seasonal filters which are by construction stable in the current domain, but this inevitably introduces a phase shift. In the paper we elaborate these arguments. Than we refer to various economic series to illustrate the properties of different classes of filters. Finally, we demonstrate and evaluate the trade-off between lack of stability in the current domain on the one hand, and phase shift on the other.

Keywords: Seasonal Adjustments, Asymmetric Filters, Amplitude, Phase

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FILTER CONSTRAINTS FOR NON-STATIONARY INTEGRATED INPUT SERIES Marc Wildi University of Applied Technical Sciences, Winterthur, marc.wildi@bluewin.ch Winfried Stier* University of St-Gallen, winfried.stier@unisg.ch

In order to extract a signal like a trend or a seasonal component from a non-stationary integrated time series the corresponding linear filter must satisfy a set of constraints depending on the characteristics of the time series (location and multiplicity of unit roots) and on the signal to be estimated (for example a trend). If the corresponding set of constraints is not satisfied, then the error (relating true an estimated signal) will not be of finite variance asymptotically. We here show that these constraints are intuitively very appealing. We also investigate consequences of ignoring such conditions for finite samples, using simulated time series. Finally, we analyze the effects of imposing unnecessarily severe restrictions on the quality of the resulting (misspecified) signal estimate.

Keywords: Signal extraction, integrated time series, filter constraints, misspecification.

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TESTING FOR FILTER CONSTRAINTS IN THE CONTEXT OF INTEGRATED INPUT SERIES Marc Wildi*

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In order to estimate a (possibly non-stationary) signal for an integrated input series, a corresponding filter must satisfy a set of constraints (which are analyzed in the preceding talk). Formal statistical instruments for deciding whether a constraint must be satisfied or not may be obtained in either of two ways. The 'traditional' model-based approach identifies a model for the time series under investigation and derives signal definitions and extraction filters. Filter constraints are then implicitely taken into account by the structure of the time series model: this amounts to a traditional unit roots testing procedure based on one-step ahead forecasting errors (of the model). We here present a method for testing for filter constraints (rather than unit roots) which explicitely takes into account the relevant filter error (rather than the 'uninteresting' one-step ahead forecasting error of the model). The distribution of the test statistic is derived. Finally, some examples demonstrate the power of the test when compared to traditional model based approaches. **Keywords:** Signal extraction, filter constraints, test statistic, asymptotic distribution.

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Wednesday, 9:50 – 11:10 --- Room: Mérida I

ORGANIZED SESSION: FORECASTING FOR REPLENISHMENT PLANNING

Organizer and Chair: Hans Levenbach

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FORECASTING INTERMITTENT DEMAND FOR INVENTORY PLANNING

Hans Levenbach* Delphus, Inc. hlevenbach@delphus.com Bill Sichel

Most approaches to forecasting intermittent demand have their origins in the Croston's method. Disadvantages of this technique are well-known in lacking realistic assumptions concerning underlying structures in the data. In addition, the Croston technique is a univariate approach that does not utilize similar patterns found in groupings of like data series found in inventory systems. In this presentation, we explore the data structures found in movement classifications (ABC codes) of inventory items and construct a framework for forecasting the demand for intermittent items in such groupings. We develop an empirical procedure that produces forecasts for the demand and for intervals between non-zero demands of the inventory items. This approach may also be applicable to forecasting intermittent demand with Point-of-Sale (POS) data for product families in a retail environment.

Keywords: Croston technique.

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THE EFFECTIVE DESIGN AND USE OF FORECASTING SUPPORT SYSTEMS FOR SUPPLY CHAIN MANAGEMENT Robert Fildes

Lancaster University Centre for Forecasting, UK, R.Fildes@Lancaster.ac.uk Paul Goodwin* The Management School, University of Bath, UK, mnspg@bath.ac.uk

Forecasts play a key role in the management of the supply chain. This paper first reviews how forecasts are produced in supply chain operations and the importance of accuracy. Forecast accuracy can usually be improved by integrating managerial judgment with statistical forecasts and forecasting support systems (FSSs) are designed to facilitate this integration. The paper then reviews evidence from both laboratory studies and preliminary fieldwork that this integration is often carried out poorly with deleterious effects on accuracy. It argues that, to underpin improved FSS design, more in-depth research is required in companies in order to determine the cognitive and organizational factors that influence how FSSs are employed. It then outlines a number of potential design features that might improve FSS use by enabling forecasters to interface effectively with statistical methods. However, it emphasizes that to be acceptable to users, such features will need to take into account the particular constraints that apply in supply chain forecasting has been overly limited in its focus on statistical issues at the expense of what is seen as important to those managing the supply chain. The presentation concludes with a proposal on how to research this complex area from a multidisciplinary standpoint.

Keywords: Supply chain forecasting, Integrating judgment

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BOOTSTRAP ESTIMATES FOR LUMPY DEMAND John Boylan* Buckinghamshire Chilterns University College, John.Boylan@bcuc.ac.uk George Karakostas

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Bootstrap estimates for intermittent and lumpy demand have been proposed in earlier papers by Willemain et al (2000) and implemented in commercial software. The main argument in favour of such an approach is that it provides ready estimates of quantiles for the whole distribution of demand over lead time, without having to rely on possibly unrealistic assumptions that demand is Poisson distributed with no auto-correlation in the time series. Although such an approach is attractive, it has not been subjected to theoretical critique. Moreover, little empirical evidence is available to evaluate the forecasting accuracy and inventory implications of a bootstrapping approach in comparison to more traditional parametric techniques. In this paper, theoretical arguments to support the bootstrap are critiqued. The classical bootstrap (Efron, 1979), the block resampling bootstrap (Carlstein, 1986) and the stationary bootstrap (Politis and Romano, 1994) are examined. Some common problems are identified for the different approaches and modifications to the bootstrap methods are proposed, to improve estimates of the mean, variance and quantiles of demand. In this paper, empirical evidence will be presented on large data sets taken from a variety of industry sectors. The forecasting accuracy of parametric methods of forecasting intermittent demand (Croston, 1972; Syntetos and Boylan, 2001) is compared with bootstrapping approaches. Likewise, the inventory implications of the two approaches are assessed. **Keywords**: Bootstrapping, intermittent, lumpy, demand.

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A COMPARISON OF METHODS FOR POINT AND INTERVAL FORECASTING OF DAILY SALES

James W. Taylor*

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Efficient production and inventory management requires accurate point forecasts and also accurate estimates of prediction intervals. Using daily supermarket sales time series, we compared point forecast accuracy of a range of exponential smoothing methods for lead times from one day to 14 days ahead. The best performing methods were smooth transition exponential smoothing and the non-standard exponential smoothing approach currently used by the collaborating company. Accuracy was improved by using a combination of methods. Since combining methods do not involve a formal procedure for identifying the underlying data-generating model, theoretical variance expressions are not easily derived. We compared several empirical methods for estimating the predictive distribution. These methods focus on the empirical fit errors. The highly volatile and heteroskedastic nature of the error series prompted the use of methods from the finance density and volatility forecasting literature. Particularly promising results were produced using quantile autoregression.

Keywords: Exponential smoothing, combining, prediction intervals.

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Wednesday, 11:25 – 12:25 --- Room: Yucatán III

PANEL

"DAMPING WORKS FOR SEASONALITY ESTIMATES" OR "HOW TO REDUCE FORECAST ERRORS BY FIVE PERCENT"

Organizer and Chair: J. Scott Armstrong

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Panelists:

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SHRINKAGE ESTIMATORS FOR DAMPING X12-ARIMA SEASONALS

Don Miller dmmiller@vcu.edu and Dan Williams daniel_williams@baruch.cuny.edu

We examine the effect of damping X-12-ARIMA's estimated seasonal variation on the accuracy of its seasonal adjustments of time series. Two methods for damping seasonals are proposed. In a simulation experiment, we generated time series data for each of 90 distinct experimental conditions that, in aggregate, characterize the variety of monthly series in the M3-competition. X-12-ARIMA consistently overestimated the actual seasonal variation by an amount consistent with statistical theory. Damped seasonals reduced X-12-ARIMA's estimation error by as much as 73%, and under no conditions was estimation error increased beyond a trivial amount. Improvement depended primarily on the degree to which random variation in a series dominated seasonal variation. One of the proposed methods was somewhat more accurate, and is somewhat more complex, than the other. Other factors examined include the presence or absence of trend, asymmetry in the seasonal pattern, and constant vs. increasing seasonal variation over time. In an analysis of real data -- the 1428 monthly series of the M3-competition -- damping X-12-ARIMA seasonals prior to forecasting (1) reduced the average forecasting MAPE by 5.4% to 2.1% and (2) improved forecasting accuracy for 59% to 64% of the series, depending on the forecasting horizon. This research suggests that damping X-12-ARIMA seasonals leads to more accurate seasonal adjustments of time series, thus providing a more reliable basis for policy-making, forecasting and planning, and the evaluation of forecasting methods by researchers.

Keywords: Damped seasonals, decomposition, empirical Bayes, seasonal variation, seasonality, shrinkage estimators, time series, X-12-ARIMA



Wednesday, 11:25 – 12:25 --- Room: Yucatán IV

CONTRIBUTED SESSION: ENTERPRISE FORECASTING

Chair: Jesús Canduela

FORECASTING ADVERTISING AWARENESS (AFTER G. BROWN) Jorge Alagón Millward Brown Mexico Felipe González* Millward Brown Mexico, Felipe.Gonzalez@mx.millwardbrown.com

We present a dynamic model for advertising awareness first proposed by Gordon Brown. The key inputs for this modelare advertising spend and an awareness index which measures the quality of the advertising. We explain how the modeler can obtain (by using commonsense and a few rules of thumb) good fits from which meaningful forecasts and learnings can result. We illustrate this with actual cases where the application of the model was successful. **Keywords:** advertising, dynamic models, forecasting.

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DIRECT AND DERIVED APPROACHES TO FORECASTING DEMAND AT THE SUBAGGREGATE LEVEL Huijing Chen*,

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Forecasting demand at the subaggregate level (eg at a branch rather than at a National Distribution Centre) is a practical and important problem many companies face. This paper summarises and critiques different approaches used to address this issue, based on a wide-ranging literature review. A simple classification method is introduced for this problem. According to this classification, there are four types of approach that have been suggested in the literature. They are the direct approach, the derived (also known as the top-down) approach, the borrowing strength approach and the combination of forecast approach. The direct and the derived approaches have been compared by a number of authors, who have considered different factors which may affect the relative performances of the two approaches. However, it is not clear from the literature when one is preferred to the other. A common weakness in published studies is that empirical evidence is lacking and when such an analysis has been conducted, the scale of the empirical investigation is too small. Closely connected with the derived approach is the sub-problem of selecting the most appropriate disaggregation mechanism. Some theoretical results on disaggregation mechanisms will be presented in this paper. Their significance will be assessed, based on simulation findngs. Later stages of the research will also be discussed, with a particular emphasis on the design of empirical analysis.

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FORECASTING DECISIONS IN COMPLEX SITUATIONS (CASE STUDY OF A FMCG ORGANISATION) Jesús Canduela*

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It is well understood that different functions in organisations have different forecasting and planning requirements and treat and value forecasts differently. This presentation is a report of a study of forecasting in a large fast moving consumer goods (fmcg) company. A series of interviews have been conducted from key points in the flow of forecasts and information through the company, from initial generation to the interface with the customer. The findings do show a difference in the value of the forecast and the way they are used or abused. Also emerging is clear indication of the social-political influences on the planning process. From this qualitative work recommendations are made on to how to improve forecasting. Finally the prospects of a unified approach which can be generalised throughout fmcg companies and up and down supply chain is discussed.

Keywords: forecasting usability, structured interview, fmcgs.

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Wednesday, 11:25 – 12:25 --- Room: Mérida II & III

ORGANIZED SESSION: ACCURACY OF ECONOMIC FORECASTS IN SWITZERLAND AND GERMANY

Organizer and Chair: Üllrich Heilemann

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CONSENSUS AND DISAGREEMENT OF GERMAN PROFESSIONAL FORECASTERS. CAN THEY HELP TO EXPLAIN FORECAST ERRORS? Jörg Döpke*

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Academic work regarding the sources of forecast errors has recently turned its attention the forecasters' behavior (Lamont 1995, Bennet and Geoum 1996). While such hypothesis have been quite successful in explaining forecast errors in financial markets, the evidence regarding professional forecasters of the business cycle is relatively scare, especially for German data. The paper aims at closing that gap. Based on data for a group of professional forecasters coming from the "Economic consensus" survey it is evaluated how individual forecasts interact with the consensus (Batchelor and Dua 1992). Based on this evidence it is discussed whether such "psychological" factors might help to explain the sign and the magnitude of German forecast errors. **Keywords**: Consensus forecasts.

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ACCURACY OF ECONOMIC FORECASTS IN SWITZERLAND. A HISTORICAL ANALYSIS

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Presently, with the obvious delay of the predicted economic upswing, the accuracy of economic forecasts has come under attack. Specifically, observers remark that frequent revisions reveal a considerable degree of arbitrariness. Moreover, it is claimed that economic forecasts are systematically biased. This critique is not addressed solely at research departments of private enterprises, where the publication of suitable forecasts may at times be seen as an element of overall business strategy, but includes government financed institutes, which are supposed to supply authorities and the public with reliable information. In Switzerland, this service to the public is assigned to the KOF at the ETH Zurich, which comes out with two forecasts per annum. In this paper, we take the recent reproaches serious and submit the KOF's economic forecasts during the last two decades to a critical analysis. To this end, we evaluate the forecasts of GDP as well as its main aggregates (private consumption and investment, government spending, foreign trade) with respect to the provisional as well as the final numbers in the official statistics. Our results are reassuring with respect to the KOF's model-based forecasts. In particular, we show that the quality of the forecast improved remarkably when the KOF switched to model-based forecasts in the early 1990es. Moreover, the fit of the forecasts is generally better with respect to final rather than provisional statistics, which implies that some of the critique in ongoing discussions may be premature. Last but not least, while we are aware of the fact that economic forecast do not deliver precise point estimates of the final outcomes, we show that the KOF's forecasts were reasonably reliable in signalling accelerating and decelerating rates of economic activity in Switzerland.

Keywords: Economic Forecasts, Main Aggregates of GDP, Ex-post Evaluation

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A BRIDGE TOO FAR? 20 YEARS OF EX ANTE FORECASTS WITH THE RWI-BUSINESS CYCLE MODEL Üllrich Heilemann* RWI/University of Duisburg, heil@rwi-essen.de

Since the late 1960s macroeconometric models play an important role in forecasting. Despite this long practice, there are few studies of their track record, in particular not for Germany. This paper analyses the accuracy of one year ahead ex ante forecasts with the RWI business cycle model, a medium sized model of the (West) German economy in operation since the late 1970s. The study concentrates on the performance of seven variables (employment, private consumption, fixed investment, exports, real GDP, consumption deflator and government deficit) for the period 1981 to 2001. Particular interest is given to evolution of forecast behaviour over time, the role of exogenous variables and the decomposition of model errors – estimation errors, simultaneity errors, dynamic errors and outside sample errors. The latter results are used to reason on the room to improve macroeconomic forecasting. **Keywords**: Forecast errors.

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Wednesday, 11:25 – 12:25 --- Room: Valladolid

CONTRIBUTED SESSION: FORECASTING AND SOCIAL ISSUES II

Chair: Antonio García-Ferrer

USING SCENARIO-BASED META-DECISION MODELS TO EVALUATE ALTERNATE EMISSION REDUCTION STRATEGIES FOR HIGH-EMITTING VEHICLE-OWNERS IN THE ATLANTA AIRSHED Asim Zia*

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Implemented under the United States Clean Air Act Amendments of 1990, vehicle inspection and maintenance (IM) programs are aimed at reducing Carbon Monoxide, Oxides of Nitrogen and Hydrocarbon emissions from high-emitting vehicles. Previous evaluations suggest that IM programs are not completely effective in reducing the emissions from high-emitting vehicles. It is hypothesized that, like many environmental management decision problems, evaluation of IM programs involves consideration of multiple, mostly incommensurate, decision criteria. Further, it is hypothesized that the weights to be assigned to multiple decision criteria are neither exogenously determinable by the policy evaluators nor endogenously inferable by applying a single decision algorithm. This paper introduces adaptive, processoriented and context-sensitive meta-decision models, which are geared towards explicitly evaluating the policy alternatives under variable weighting combination scenarios of multiple decision criteria. In particular, the IM program in the Atlanta airshed is evaluated according to a simple bi-criteria meta-decision model by applying cost-effectiveness and GINI coefficient decision rules. Under multiple scenarios of variable weighting combinations of cost-effectiveness and equity decision criteria, it is learnt that the current IM program is not only less cost-effective than it should be, but also is grossly inequitable in its distribution of repair costs. About 10% of the vehicle owners, mostly poor, are required to bear over 80% of the repair costs. Comparing the IM program with three other hypothetical emission reduction policy alternatives, this paper concludes that the alternative of a clean screening and a repair subsidy program can potentially be both more cost-effective and equitable than the current IM program. Further, it is concluded that meta-decision models should be iteratively applied to take into account the changing technological and social contexts embedded in environmental management decisions.

Keywords: air quality management, scenario management, multiple criteria decision-making, transportation planning.

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A GENERAL PREDICTION INTERVAL GENERATING METHOD WITH HISTORICAL FORECAST ERROR BASED MODELING Jerry Shan*

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Suppose on a given day in a month, we come up with a point prediction of HP revenue for the whole month, then what are the most likely ranges? Obviously, providing this can enable different strategies to be planned. However, this does seem to be a classic interval prediction problem. Now suppose we have a method to generate point predictions but there is no ready mechanism in the method to generate a confidence interval, then what can we do? The point prediction method that we successfully developed for the revenue prediction in HP has exactly this characteristic. This paper developed a general solution for generating confidence prediction intervals with any point prediction method. The main ideas are as follows. For a given point prediction method, we apply it on a selection of historical months, get the daily predictions for each month and the forecast errors. Then we fit a probability distribution for the error on each day. Note that for the given point prediction method and its actual performance on the historical months, the derived distribution is therefore the best fit, prior to its observation, for the error that would arise from the new forecasting month, as it reflects and models the possible errors by the method to the maximum that the empirical evidence can support. We proceed to model the daily forecast error for the new forecasting month by the derived distribution, and construct a confidence statement on the error part. We then perform bias detection and correction, and convert the confidence statement in terms of the predicted actual. Finally, we synthesize the confidence interval with the point prediction derived separately by the point prediction method, to arrive at a complete confidence interval prediction for the new forecasting month. Keywords: Prediction interval, financial metrics, forecast error

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MONITORING, FORECASTING AND CONTROL OF ROAD ACCIDENT RATES: PRELIMINARY RESULTS FROM THE *FMCAR* PROYECT

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The main objective of this project is the development of statistical process control (SPC) techniques that could be used in controlling stochastic economic time series. Directly related with this methodological objective, the project also tries to create a monthly forecasting and monitoring system for transportation indicators related to accident rates in Spain. Accordingly, we seek the development of a monitoring scheme that examines these indicators on a monthly (or quarterly, where applicable) basis to provide alerts when those measures deviate more than could be reasonably expected. The reason for using time series DHR models is to break a series down into its core components: trend, seasonal and irregular, so that we may examine them separately. Later on, SPC techniques will be used in search for changes in those components, level shifts and outliers among the residuals, possible common movements in the trends and/or seasonal components and the presence of temporary and permanent changes in the series. Additionally, the project also tries to implement the new BGF algorithm (within Matlab) that allows automatic identification, estimation, smoothing and forecasting of these models. These algorithms will be of public domain from the department's web page. **Keywords**: Unobserved component models.

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Wednesday, 11:25 – 12:25 --- Room: Mérida I

CONTRIBUTED SESSION: MACROECONOMIC FORECASTING IV

Chair: Eduardo Loría

HOW ACCURATE ARE THE SWEDISH FORECASTERS ON GDP, CPI AND UNEMPLOYMENT? (1993–2001). Bharat Barot*

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This study evaluates the performance of the Swedish domestic forecasts of real GDP growth, CPI and unemployment for the sample period 1993-2001. The Swedish forecasters under scrutinization are the National Institute of Economic Research, the Ministry of Finance, Confederation of Swedish Enterprise, Handelns Utredningsinstitut, the Swedish Central Bank, Handelsbanken, Nordea, and finally the SEB group. The forecasts that are evaluated are the spring, summer, autumn and the December forecasts. The questions addressed are the following: Has the mean absolute error and the root mean square error delined over the different forecasting occasions? Have the Swedish forecasters been able to predict the directional accuracy correctly? Have the Swedish forecasters been able to beat the naive random walk and the random walk model with drift? Have the forecasts been biased tending to systematically under predict or over predict GDP growth, CPI and unemployment? Have the Swedish forecasters been able to perform better with preliminary or final gdp actuals? Are the current year forecasts better than a year ahead forecasts? The results indicate that the average errors are large in terms of both their variance and the importance of the variables. The current forecasts compared to the year ahead forecasts decline over the forecasting horizons as more information becomes available. The results with respect to the directional accuracy indicate that we are equally good/bad in predicting the directional accuracy for GDP, CPI and the unemployment variable. According to the comparisons with the naive random walk model six out of seven Swedish CPI forecasters were beaten by the naive random walk model. Tests of bias indicate that the Swedish forecasters underestimate GDP and overestimate CPI and the unemployment rate for the sample period. All the Swedish forecasters have been successful in predicting the downward trend in CPI and the unemployment rate. The performance of the Swedish domestic forecasters is better using preliminary GDP outcomes than final.

Keywords: Mean absolute error, root mean square error, directional accuracy, bias, revisions.

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FORECASTING FORMAL EMPLOYMENT IN MEXICO: A COINTEGRATION APPROACH Rodrigo García-Verdú Dirección de Estudios Económicos, Banco de México, rgarciav@banxico.org.mx

Eduardo Rocha Torres* Dirección de Estudios Económicos, Banco de México, rgarciav@banxico.org.mx

This paper develops an econometric model to forecast employment and estimates it using quarterly data on formal employment, average wages in the manufacturing sector, and real GDP in Mexico for the period 1996:1-2002:4. Forecasting employment is important for central banks because of the importance of the labor market on inflation, and for governments in general because of its impact on public finances through its effects on tax revenue and social security contributions. The model developed is based on a cointegration relationship between employment, real income, and real wages which implies that the share of labor on total income is constant over time. The cointegrating vector relates the levels of output, wages and employment. This cointegrating vector is estimated through an error correction equation that includes the first differences of output, wages, and employment. The paper presents both theoretical and empirical evidence to justify the choice of functional form. The approach used is novel since most other aggregate models of employment have been based on either estimating a demand equation or a system of simultaneous equations. Finally, the model compares the employment forecasts with those of a typical labor demand equation. The results suggest the model fits the data better than the of the traditional model in out-of-sample forecasts. **Keywords**: Econometric Model, Cointegration, Error Correction Model, Forecasting, Employment, Mexico

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FOREIGN DIRECT INVESTMENT IMPACTS ON SECTORIAL EMPLOYMENT IN MEXICO: A PROSPECTIVE ANALYSIS (2003-2013)

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In spite of the outstanding importance of employment, little has been done to approach it in a sectorial analysis and for long periods using complete econometric models. This article presents three prospective scenarios for the time period 2003-2013, based upon different behaviors of the foreign direct investment.

Keywords: Sectorial employment, prospective, structural change, foreign direct investment, simultaneous equations.

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