The 34th International Symposium on Forecasting

ISF 2014

PROCEEDINGS

Rotterdam, The Netherlands   June 29–July 2, 2014

Keynote Speaker
Date: Monday June 30, 8:45-9:45am
Venue: Willem Burger
Chair: Philip Hans Franses (Erasmus University Rotterdam)

Europe, a Great History, also a Great Future?

Jan Peter Balkenende
Professor of Governance, Institutions and Internationalisation
Erasmus School of Economics
Former Prime Minister of the Netherlands

Bio: After completing his secondary education Jan Peter Balkenende went on to the Free University of Amsterdam (VU) where he studied history (graduating with an M.A. in 1980, with economic and social history as his main subject and economics and political science as subsidiary subjects) and Dutch law (graduating with an LL.M. in 1982, with public law as his main subject). He obtained his Ph.D. in law in 1992 with a thesis on government regulation and civil society organizations.

Professor Balkenende was a member of Amstelveen municipal council from 1982 to 1998, and leader of its Christian Democrats group from 1994. From 1993 to 2002 he was professor (part-time) of Christian thought on society and economics at the Faculty of Economics of the Free University of Amsterdam.

From 1998 to 2002 he was a member of the House of Representatives of the States General for the Christian Democrats (CDA) and financial spokesperson for the CDA parliamentary party. He was leader of the parliamentary party from October 2001.

On 22 July 2002, Professor Balkenende was appointed Prime Minister and Minister of General Affairs in the first of four administrations to bear his name. His fourth term of office as Prime Minister ran from February 2007 to October 2010.

Keynote Speaker – Arnold Zellner Memorial Keynote Address
Date: Monday June 30, 2:00-3:00pm
Venue: Willem Burger
Chair: Herman K. van Dijk (Erasmus University Rotterdam and VU University Amsterdam)

Economic Forecasting with Big Data: Challenges and Opportunities

John Geweke
Distinguished Research Professor
University of Technology, Sydney

Abstract: The capacity to store, retrieve and manipulate large volumes of data has grown dramatically in recent years and will continue to do so in the foreseeable future. These innovations bear on all established agendas in economic forecasting and define new ones. For example, Internet searches related to job-seeking activity provide information about labor market and macroeconomic developments more timely than official government statistics; feedback from internet searches is used to forecast individual market behavior and guide advertising. Improved forecasting with big data demands re-thinking models, data structures and statistical methodology. Econometricians have yet to contribute substantially to this process, which to date has been dominated by machine learning in computer science. The talk will discuss the substantial contributions that econometricians can make. It will discuss some specific examples drawn from the agenda of the recently established Australian Research Council Centre of Excellence for Mathematical and Statistical Frontiers of Big Data, Big Models, New Insights.

Bio: Professor Geweke is distinguished for his contributions to econometric theory in time series analysis and Bayesian modelling, and for applications in the fields of macroeconomics, finance, and microeconomics. He joined UTS as Distinguished Research Professor in the School of Business in 2009. He is a Fellow of the Econometric Society and the American Statistical Association. He has been co-editor of the *Journal of Econometrics*, the *Journal of Applied Econometrics*, and editor of the *Journal of Business and Economic Statistics*. His most recent book is *Complete and Incomplete Econometric Models*, published by Princeton University Press in January 2010. Currently he directs the six-investigator ARC – sponsored project, "Massively Parallel Algorithms for Bayesian Inference and Decision Making."

Keynote Speaker
Date: Tuesday July 1, 8:45-9:45am
Venue: Willem Burger
Chair: Dick van Dijk (Erasmus University Rotterdam)

Forecasting for Pension Investment

Angelien Kemna
CIO APG Group

Bio: Dr. Angelien Kemna (1957) has been a Member of the Executive Board of directors and Chief Investment Officer of APG Group since 1 November 2009. APG manages EUR 359 billion (April 2014) in pension fund assets.

From 2002 to July 2007, Kemna was Chief Executive Officer of ING Investment Management Europe with responsibility for investing over EUR 150 billion. From 2001 to 2004, she was Director of investments worldwide. Prior to that, she held various positions at Robeco Group. During this period, she was also part-time Professor of Financial Markets at the University of Maastricht (1993–1999).

Prior to her career in the investment industry, Angelien Kemna pursued an academic career. From 1988 to 1991, she worked at the Erasmus University where she obtained her doctorate in 1988 in the field of financial and real options.

Angelien Kemna holds various supervisory and advisory positions. She is a Member of the Board of Governors of the University of Leiden and Chairman of the Supervisory Board of Yellow and Blue, a Dutch venture capital firm in the field of renewable energy. In addition, Kemna is a Board Member of the Duisenberg School of Finance.

Keynote Speaker
Date: Tuesday July 1, 2:00-3:00pm
Venue: Willem Burger
Chair: Philip Hans Franses (Erasmus University Rotterdam)

Mainport as a System

Jos Nijhuis
CEO Schiphol Group

Bio: Having joined Schiphol Group as a Board member in 2008, Jos A. Nijhuis (56) was appointed President & CEO from 1 January 2009 and re-appointed per 2012. He is also non-Executive Director of Aéroports de Paris. Jos Nijhuis started his career as an accountant and worked for many years (1980-2008) at PricewaterhouseCoopers in various management capacities, most recently as Chairman of the Board of Management.

Jos Nijhuis is a member of the ACI Europe Board and the Executive Committee. He is a member of the Supervisory Board of SNS Reaal and is also active in the social sector as a board member of Stichting Nationale Opera & Ballet.

Keynote Speaker
Date: Wednesday July 2, 8:45-9:45am
Venue: Willem Burger
Chair: Dick van Dijk (Erasmus University Rotterdam)

Economic Theory and Forecasting: Some Lessons from the Literature

Raffaella Giacomini
Associate Professor of Economics
University College, London

Abstract: Does economic theory help in forecasting key macroeconomic variables? We provide some insight into the question by drawing lessons from the literature. What we define as "theory" includes a broad range of examples: the use of accounting identities; spatial restrictions when forecasting variables aggregated over regions; partial equilibrium restrictions such as Taylor rules for inflation, Purchasing Power Parity for exchange rates and Euler equations; cointegration; forecasting with no-arbitrage term structure models or Dynamic Stochastic General Equilibrium (DSGE) models. We also consider different ways of incorporating theory into forecasting, such as theory-guided variable selection; imposing theoretical restrictions on reduced-form models; using priors based on a theoretical model to perform Bayesian inference in reduced-form models; combining theoretical and reduced-form models; forecasting with estimated DSGE models.

Bio: Raffaella Giacomini obtained her Ph.D in Economics at University of California, San Diego in 2003. From 2004-2008 she was Assistant Professor at UCLA, after which she moved to London to join the Department of Economics at UCL as an Associate Professor. Over the last decade, she has made important contributions in time series econometrics, forecasting, and applied macroeconomics. Current research includes (i) understanding whether economic theory is useful for forecasting; (ii) yield curve modelling and forecasting; and (iii) forecasting with judgment.

Featured Speaker – IJF Editor's Invited Lecture
Date: Tuesday July 1, 4:30-5:30pm
Venue: Willem Burger
Chair: Rob Hyndman (Monash University)

Confidence Bounds and Forecast Bands for Time-Varying Parameters in Observation-Driven Models

Siem Jan Koopman
Professor of Econometrics
VU University Amsterdam

Abstract: This paper develops analytic confidence bounds and forecast bands for time-varying parameters in a wide range of observation-driven models and for a wide range of different estimation procedures. In-sample confidence bounds reflect estimation uncertainty. Out-of-sample forecast bands reflect innovation uncertainty. Monte Carlo studies for a generalized autoregressive conditional heteroskedasticity (GARCH) model, an autoregressive conditional duration (ACD) model, and a generalized autoregressive score (GAS) local-level model reveal that the actual coverage of the analytical bounds is close to the nominal coverage. The presented confidence bounds and forecast bands for time-varying parameters in real data settings reveal the practical importance of our findings.

Bio: Siem Jan Koopman is Professor of Econometrics at the Vrije Universiteit Amsterdam and research fellow at the Tinbergen Institute, both since 1999. Furthermore, he is a long-term Visiting Professor at CREATES, University of Aarhus and a Visiting Researcher at the European Central Bank, Financial Research.

Previously he held positions at the London School of Economics between 1992 and 1997 and at the CentER (Tilburg University) between 1997 and 1999. His Ph.D. is from the LSE and dates back to 1992.

Professor Koopman is internationally renowned for his contributions to time series econometrics, in particular state space methods. Together with Professor Jim Durbin, he wrote the monograph *Time Series Analysis by State Space Methods*, published by Oxford University Press in 2001. A second edition was recently published in May 2012. The research interests of SJK cover topics in statistical analysis of time series, financial econometrics, simulation-based estimation, Kalman filter, and economic forecasting.

He fulfills editorial duties at the *Journal of Applied Econometrics* and the *Journal of Forecasting*. Finally he is an OxMetrics software developer and is actively engaged in the development of the time series software packages STAMP and SsfPack.

MBD1   Big data analytics and forecasting (RAstaNEWS)

Date: Monday June 30, 11:25am-12:45pm
Chair: Alessia Paccagnini (Università degli Studi Milano–Bicocca)

ID41 Inske Pirschel (Kiel Institute for the World Economy) – *Forecasting German key macroeconomic variables using large dataset methods*, co-author: Maik Wolters, Kiel Institute for the World Economy

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Abstract: We study the performance of three alternative approaches to forecast German key macroeconomic variables using a dataset that consists of 123 variables in quarterly frequency. These three approaches handle the dimensionality problem evoked by such a large dataset by aggregating information, yet on different levels. We consider different factor models, a large Bayesian VAR and model averaging techniques, where aggregation takes place before, during and after the estimation of the different models, respectively. We compute forecasts for a set of eleven core macroeconomic variables including GDP growth and CPI inflation. We find that overall the large Bayesian VAR provides the most precise forecasts compared to the other large scale approaches and a number of small benchmark models. For some variables the large Bayesian VAR is also the only model producing unbiased forecasts at least for short horizons. While a Bayesian FAVAR with a tight prior also performs quite well overall, the other methods dominate the simple benchmark models only for some of the variables.

ID111 Eleonora Granziera (BI Norwegian School of Business) – *The Conditional Predictive Ability of Economic Variables*, co-author: Tatevik Sekhposyan, Bank of Canada

E-mail: eleonora.granziera@gmail.com

Abstract: The relative performances of forecasting models are known to be rather unstable over time. However, it is not very well understood why the forecasting performance of economic models change. We propose to address this question by evaluating the predictive ability of a wide range of economic variables for key U.S. macroeconomic aggregates: output growth and inflation. We take a conditional view on this issue, attempting to identify situations where particular kind of models perform better than simple benchmarks. Furthermore, we investigate whether incorporating the conditioning information into the original model specification or using it as a model selection criteria for model averaging could improve the accuracy of the predictions.

ID210 Christian Kascha (University of Zurich) - *Forecasting VARs, Model Selection, and Shrinkage*. Co-author: Carsten Trenkler, University of Mannheim

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Abstract: In the last decade, various shrinkage estimation and / or selection methods such as the LASSO have become popular in the statistical literature. However, there is limited evidence on the forecasting performance of these methods for vector autoregressive (VAR) models, apart from evidence on the performance of Bayesian shrinkage. In particular, we do not know when there is a difference between these methods, which strategy is likely to work best under which circumstances and how to these methods work in interaction with other specification choices such as the size of the VAR and its lag length. This paper tries to fill part of this gap by comparing the forecast performance of (i) traditional selection methods (ii) regularization methods and (iii) empirical Bayesian methods for a quarterly US data set. Our main results are as follows. We find that an expanding estimation window combined with cross-validation for

determining the tuning parameters of the models work best in our context, even though other choices do not yield very different results. There was no method that worked best under all circumstances, however, traditional selection methods such as top-down selection or sequential elimination of regressors were dominated by the other methods. Ironically, the choice of the lag length (estimation method) was often more decisive for forecasting performance than the choice of the shrinkage method. In agreement with the literature, we find that augmenting the system size combined with shrinkage yields considerably better forecasting performance even though we find that these improvements essentially disappear after horizon one.

ID163 Alessia Paccagnini (Università degli Studi Milano–Bicocca) – *Policy oriented macroeconomic forecasting with hybrid DGSE and time varying parameter VAR models*, co-author Stelios Bekiros, Athens University of Economics and Business and EUI
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Abstract: Micro-founded dynamic stochastic general equilibrium (DSGE) models appear to be particularly suited for evaluating the consequences of alternative macroeconomic policies. Recently, increasing efforts have been undertaken by policymakers to use these models for forecasting, although this proved to be problematic due to estimation and identification issues. Hybrid DSGE models have become popular for dealing with some of model misspecifications and the trade-off between theoretical coherence and empirical fit, thus allowing them to compete in terms of predictability with VAR models. However, DSGE and VAR models are still linear and they do not consider time-variation in parameters that could account for inherent nonlinearities and capture the adaptive underlying structure of the economy in a robust manner. This study conducts a comparative evaluation of the out-of-sample predictive performance of many different specifications of DSGE models and various classes of VAR models, using datasets for the real GDP, the harmonized CPI and the nominal short-term interest rate series in the Euro area. Simple and hybrid DSGE models were implemented including DSGE-VAR and Factor Augmented DGSE, and tested against standard, Bayesian and Factor Augmented VARs. Moreover, a new state-space time-varying VAR model is presented. The total period spanned from 1970:1 to 2010:4 with an out-of-sample testing period of 2006:1-2010:4, which covers the global financial crisis and the EU debt crisis. The results of this study can be useful in conducting monetary policy analysis and macro-forecasting in the Euro area.

ID40 Xihao Li (Università Politecnica delle Marche) – *Stock-flow dynamic prediction,* co-author: Mauro Gallegati, Università Politecnica delle Marche
E-mail: xihao.li@gmail.com
Abstract: This paper considers economic system as multi-level dynamical system that micro-level agents' interaction derives macro-level market dynamics with endogenous fluctuation or even market crashes. By the concept of transition matrix, we conduct a computational method to quantify meso-level structural change induced by micro-level interaction. Then we apply this quantification to develop a method of dynamic projection that derives out-of-sample forecasting of macro-level economic variable from micro-level Big Data. We testify this technique of dynamic projection with a data set of financial statements for 4599 firms listed in Tokyo Stock Exchange for the year of 1980 to 2012. The Diebold-Mariano test indicates that the dynamic projection has significantly higher accuracy for one-period-ahead out-of-sample forecasting than the benchmark of ARIMA models.

MBD2   Text mining

Date: Monday June 30, 3:00-4:00pm
Venue: Van Rijckevorsel
Chair: Viorel Milea (Erasmus University Rotterdam)

ID247   Andy Moniz (Rotterdam School of Management) – *Reputational DAMAGE: Classifying the negative impact of allegations of corporate misbehavior expressed in the financial media*, co-authors Franciska de Jong, Erasmus University; Kim Schouten, Erasmus University
E-mail: andy.moniz@apg-am.nl
Abstract: In this study we design an automated Online Reputation Management (ORM) system that mines news texts in financial media. The underlying model we propose classifies the negative impact of financial media allegations of corporate irresponsible behavior on firm reputation. The system is based on the assumption that the stronger the media's attributions of organizational responsibility for a crisis, the more likely it is that a crisis will damage firm reputation. ORM will enable corporate communications departments to use a pre-specified set of rules and thresholds as a prediction tool for corporate reputation. The model works in four phases. First, it detects the type of corporate irresponsible behavior using a multinomial Naïve Bayesian model for topic classification. Second, we extend the term-counting approach by taking intensifiers into account, that incorporate LDA topic clusters to capture the degree to which the media attribute responsibility for a crisis to the organization. Third, the model computes the media sentiment expressed in each document by counting terms from the General Inquirer dictionary. Finally, the model combines the components using a classification tree that predicts the impact of financial media allegations on corporate reputation. We evaluate model classification using reputational ratings obtained from Fortune Magazine's annual survey of the "World's Most Admired Companies".

ID198 Alex Brojba-Micu (KPN Consulting) - *StockWatcher 2.0: Using Text Analysis to Predict Stock Market Trends*
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Abstract: This study proposes StockWatcher 2.0, an application which predicts the stock price for NASDAQ listed companies by analyzing events reported in news items. StockWatcher 2.0 uses a series of natural language processing algorithms to identify, extract, and disambiguate economic events in order to calculate their possible impact on the future stock price. We tested our application on a real-world dataset by generating buy/sell signals for certain periods of time. Acting on these signals resulted in 6.42% actual investment excess returns compared to the NASDAQ index return for the period of 2011.

ID359 Viorel Milea (Erasmus University Rotterdam) - *Big Data Forecasting*
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Abstract: The high volume of data available today, mostly through online sources, challenges the traditional approaches towards gaining insights from data and translating these insights into actionable knowledge. Organizations seeking differentiation within markets turn to 'big data' as factor of production. In this talk, we focus on the use of unstructured data - data in the form of text, such as news messages, Tweets, etc. We give an overview of available techniques and methodologies, and provide examples of applications with a focus on News Analytics for stock market forecasting.

MBD3   Exploiting forecasting for gaining new insights in Big Data analytics
Date: Monday June 30, 4:30-5:30pm
Venue: Van Rijckevorsel
Chair: Ron Levkovitz (Ogentech Ltd)

ID369 Anthony Nikolai (Whirlpool Corp) - *Achieving a sustained accuracy of forecasting demand*, co-author: Ron Levkovitz, Ogentech Ltd.
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Abstract: The electrical home appliances market is one of the toughest, most competitive manufacturing fields today. The fierce competition, changing economic conditions and the desire for reduced costs of electrical appliances force the manufacturers to improve their supply chains or they face losing business. A major part of improving their supply chains is increasing the forecast accuracy. The stiff competition, product life cycles of 2-3 years, and the strong influence of macro economic development (for example, the ups and downs of the construction market) make forecasting demand and projections for home appliances highly complicated. An initiative to re-structure the Whirlpool demand planning, that started four years ago, has successfully improved the statistical forecast accuracy by more than 15% and the final forecast accuracy by at least 10%. This was achieved together with a +50% reduction in the number of planners. In this talk we provide some insights to improve modelling of forecasts that use all available data including detailed life cycles, trade partners data and promotional information to help achieve and sustain the accuracy improvements.

ID370   Sharon Hovav (Clalit Health Services) - *Strategic design for forecasting, replenishment and inventory planning process for an HMO in healthcare supply chain: Increasing the human resource potential while acknowledging forecasting limitations*, Co-authors: Eugene Levner, Ashqelon Academic College; Amir Elalouf, Bar Ilan University; Avi Hebron, Bar Ilan University
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Abstract: Inventory planning and replenishment processes are an integral part of the large healthcare management organization (HMO) operating a large-scale healthcare supply chain (HSC). These processes have implications on the entire performance of the supply chain and on the efficient functioning of the end units (e.g. pharmacies and hospital warehouses). There are several elements in choosing the forecasting processes which are the basis for the global demand planning and the local replenishment planning. This talk will present the theoretical and practical elements and demonstrate them by analysing a case study. The planning and replenishment processes include, beyond the forecast accuracy or the safety stock planning, the analysis of the forecasting accuracy potential (noise dependent) and also the managerial attention of the inventory planners. While in logistical centers the planners typically need to control up to 300 items each, in the end units they have to control up to 1500 each. The tools and their usage are, therefore, completely different. Two strategies will be presented for managing the above situations: 1. Global forecasting and planning - usage of multi-echelon forecasting tools adapted to the supply chain structure. Combination of the demand and consumption at every hierarchy level and a continuous performance measurement of the forecasting system and the contribution of the planners. 2. Local replenishment - combination of the automatic forecasting and the inventory planner. With the ability to automatically distinguish between statistical ability for automatic replenishment and the need for manual intervention in the processes. Replenishment methodologies are based on two concepts "push" and "pull", where the differences are basically in planners'

intervention. Our concept is finding the optimal mix of the both. The added value for the HMO supply chain is: 1. Availability of medications and continuity of the medical treatment (direct influence on the HMO) 2. Increase of the customers' satisfaction 3. Balanced inventory based on the defined targets 4. Proper use of human resource potential, which is the minimum necessary intervention of planners. a. Reduction of the involvement and time spent by pharmacists on replenishment and ordering procedures. b. Reducing the need to rewrite an alternative prescription by doctors I in case of shortages.

ID368   Ron Levkovitz (Ogentech Ltd) - *Forecasting with big data: using all available information to improve forecasting accuracy*

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Abstract: Classic demand forecasting approach was, for many years, keep it simple (KIS). The KIS approach acknowledges the fact that it is very difficult, and many times impossible, to deal with the complexities of true life situations. It is better, therefore, to use rough estimation that, hopefully, provides some helpful insights. The fear from the, all too common, bad forecasting due to noise over fitting means that most forecasting system succumb to the notion that the only thing that can be truly forecasted are long term trends and very simple seasonality patterns. This approach is very common. All resource planning (MRP) and demand planning of the big ERP manufacturers use this approach. When applying this in a real forecasting or demand planning system we get statistical forecasts that are overly simplistic with trends that never change or, at most, are artificially damped. We get seasonality that is many times in the wrong months and does not take into account changes in the economical climate or in the seasonal behavior. Worst of all, we get a forecast that is seemingly baseline but, in fact, includes many activities that are not cleaned or are badly cleaned. Statistical forecasts, unlike human predictions, should be unbiased interpretation of the available data and, thus, provide an invaluable input to the planning and budgeting processes. Planners that receive KIS generated forecasts, however, tend to ignore them or, if forced to use them, change them beyond recognition. Financial predictions based on these forecasts provide poor estimates and are often inferior to simple moving averages. When this happens, it is very difficult to find a perceivable benefit from using a statistical forecast in the planning process. The recently acquired ability to accumulate, process and gain insights from huge amounts of, partially unstructured, data (big data) provides a new opportunity to improve forecasts. The improvements are achieved by exploiting different, alternative informations from various sources: internal, social, Internet retail, etc. In this session we present the alternative approach to KIS, of trying to use all available information to enrich the forecast. The aim is to create forecasts that are accurate enough and rich enough to be accepted without manual intervention. This requires algorithms that can use alternative sources (e.g. social networks) of data that are partial (e.g. POS data) and often not fully reliable. Inclusion of these data in the statistical planning process requires structuring and an algorithmic ability to exploit them properly without falling into the trap of fully relying on them.

MBD4   Data mining in macroeconomic forecasting

Date: Tuesday July 1, 10:00-11:00pm
Venue: Van Rijckevorsel
Chair: Boriss Siliverstovs (KOF, ETH Zurich)

ID114 Dirk Ulbricht (DIW Berlin) - *Identifying country specific r-word indicators and their use for forecasting industrial production*, Co-author:
Konstantin A. Kholodilin, DIW
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Abstract: The r-word indicator has a proven track record as a leading economic indicator. A major drawback is that reports on international recessions induce a bias. This paper presents r-word indicators of several European countries and compares their predictive power. Deviations of the means are employed to work out country specific information. The predictive power of indicators based on the raw r-word counts as well as the indicators corrected for the international bias is compared. The results of a pseudo out-of-sample forecasting experiment targeting industrial production show that filtering international noise significantly improves forecasts, especially during the financial crisis.

ID282   Klaus Wohlrabe (Ifo Institute) - *Micro Information Dynamics: Decomposing the Forecasting Power of Aggregate Indicators*, Co-author: George
Strasser, Boston College
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Abstract: Indicators based on surveys mix responses from a very heterogeneous set of respond-ents. In this paper we explore whether maintaining the full range of respondents is worthwhile, or if focusing on subsets of respondents improves the forecast performance. Further, indicators based on aggregate averages ignore an important part of information. We introduce additional measures derived from micro survey data. These include entro-py, standard deviation, disagreement between firms and combinations of them. Fur-thermore we split the sample into different subcategories. Beside the standard ones (size and branches), we also categorize firms by their answering characteristics (switching behavior or consistent answering). We employ a large micro data set from the Ifo Busi-ness Survey. Our target variable is industrial production in Germany. We demonstrate that forecasting accuracy can be improved by using specific information sets. Further-more, we uncover the sources of forecasting accuracy.

ID230 Boriss Siliverstovs (KOF, ETH Zurich) - *Short-term forecasting with mixed-frequency data: A MIDASSO approach*
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Abstract: We suggest an approach for short-term forecasting of quarterly macroeconomic variables using monthly economic indicators. The fact that these indicators are more timely available than macroeconomic variables of interest raises a question of to explore this information for accurate forecasting of current economic conditions. The demand for such forecasting techniques linking variables at different frequencies was significantly spurred by the recent outbreak of the Great Recession. The MIDASSO approach combines two recent advances in econometrics of big data and mixed-frequency data sets. The first methodology, advanced in Bai and Ng (2008), is the use of targeted predictors for forecasting variables of interest. The main idea of Bai and Ng (2008) is that prior to extracting diffusion indices from large panels of economic indicators, a pre-selection of most relevant indicators for a particular target variable is

highly advisable. More generally, by including too many irrelevant and noisy indicators in the information set may result in suppressing the signal-to-noise ratio in the data, and hence obscure accurate signal detection leading to worsening of forecast quality. Bai and Ng (2008) suggest to use penalized least squares regressions – a so-called elastic net – that are can be formulated in terms of the Least Absolute Shrinkage and Selection Operator (LASSO) of Tibshirani (1996), for a pre-selection of so-called targeted predictors that are most relevant for a specific variable of interest. The modelling approach of Bai and Ng (2008) is applied to single-frequency (monthly) data but as shown in our paper, it can be easily extended to the mixed-frequency data sets. To do so, we rely on a recently proposed Unrestricted U-MIDAS regressions (Foroni et al., 2011) as a variant of a more general Mixed-frequency DAta Sampling (MIDAS, in short) approach of Ghysels et al. (2004, 2007). Both the classical and U-MIDAS regressions are based on the skip sampling procedure, when a time series observed at the higher frequency is converted to a number of lower-frequency time series. For example, in case of variables observed at the monthly and quarterly frequencies, the monthly indicators are broken into three quarterly time series, each retaining the corresponding values in first, second, and third months of each quarter in the sample. The difference between the MIDAS regressions of Ghysels et al. (2004, 2007) and U-MIDAS regressions is that the latter is based on the direct estimation of the coefficients of the skip-sampled time series by means of the OLS method, whereas the former approach involves the use of tightly specified lag polynomials, e.g. Exponential Almon or Beta function polynomials, and the subsequent need for non-linear optimization techniques for coefficient estimation. In the MIDASSO approach both targeted regressor and U-MIDAS regressions are combined, allowing for fast and efficient estimation of the forecasting model parameters. We illustrate our approach by forecasting Swiss macroeconomic variables using a large panel of monthly data including surveys, stock market data, and exports/imports indices.

ID185 Floris van Ruth (Accenture analytics) – *Predicting the sign of changes in short-term economic statistics; a race of horses, camels and dogs*
E-mail: fjvanruth@gmail.com
Abstract: In the analysis of and reporting on the key monthly economic indicators, the emphasis has been shifting to analyzing short term developments. This process has only been accelerated by the economic crisis which started in 2008. The focus is now on month on month changes in these short-term statistics. Due to the nature of the data and the processes they describes, these period on period changes tend to be relatively noisy. The consequence is that it is often uncertain whether an observed increase or decrease will persist. A forecast of future developments can of course assist in the analysis. However, precisely because of the noisy nature of the data, this can be difficult. A less ambitious approach can potentially be more successful, and still yield useful information. The paper focuses on predicting the sign of the next period on period change in key short-term economic statistics, i.e. whether it will be an increase or a decrease. These forecasts can help in analyzing current conditions by giving an indication of whether the observed current periods development is likely to persists. While not as powerful as an actual point estimate, this type of information still provided useful context. As we are dealing with short-term statistics in a dynamic world, the paper focusses on techniques which make the most of the available information, are robust and which can lead to a low-maintenance monthly estimation process. In practice this means using techniques, which require little or no variable selection. In the study, the forecasting performance of both 'traditional' time series techniques and machine learning

techniques was compared. The former consisted of logit and OLS models based on automatic variable selection and a dynamic factor-approach, and forecasts obtained from ensemble techniques. For the latter category, classification forecasts were obtained from a number of machine learning algorithms; i.e. SVM, boosting, bagging, LDA, tree, and random forest. The data used consisted of monthly observations between 1990 and 2013 of Dutch consumer and producer confidence, manufacturing production, exports and household consumption. The results of the forecasting exercise show the difficulty of forecasting short-term developments in these noisy data, with the maximum accuracy achieved standing at 80% correct calls. This was achieved by a variable selection algorithm. Overall, machine learning algorithms tended to perform as well or better than time series models. However an evaluation exercise using random sampling showed that these results were not robust, and that the expected accuracy will probably be lower. This is due to the fact that the number of observations available in economic data tends to be too low for reliable use of machine learning algorithms. In general, an accuracy of around 70% correctly predicted sign changes can be expected. This is at the lower end of usefulness.

MBD5   Automated forecasting

Date: Tuesday July 1, 11:25am-12:45pm
Venue: Van Rijckevorsel
Chair: Nikoletta Zampeta Legaki (National Technical University of Athens)

ID153 Victor Richmond Jose (Georgetown University) - *Trimming Overconfident Weak Learners*, co-authors: Yael Grushka-Cockayne, University of Virginia, Kenneth Lichtendahl, University of Virginia
E-mail: vrj2@georgetown.edu
Abstract: We consider the challenge of ensembling forecasts when experts and/or models are overconfident, weak learners. In particular, we propose, operationalize, and test the trimmed average distributional forecast as an alternative to the popular linear opinion pool in random forests. We show that this approach is robust, able to improve calibration, and distills well the wisdom of the crowds. Using a simple information structure model, we present some theoretical results for this approach and derive some optimal levels of trimming. We also provide some simple numerical illustrations and analysis using some business and economic examples such as median housing price estimation, diamond price prediction, and bicycle rental demand forecasting.

ID180 Zhehao Cai - Development of Automatic Real Time Mortgage Risk Model to Provide Early Warning of Delinquency
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Abstract: China, as an emerging economic entity, the national strength and economic strength has grown rapidly, and the gross domestic product (GDP) growth rate has remained as high as 8% in the past decades. However, potential risks exist behind the appearance of prosperity. Although the economy of China has reached a level that cannot be ignored, some basic economic system in China is still not well established, and will bring great risks. Among the risks, credit system is the most significant one. At present, the credit score is mainly used in mortgage application and approval. However, due to long term and large amount of balance of mortgage, it is critical to monitor the risk during the performance period. In this project, mortgage initiation and performance data of 49,999 observations from a financial institution were analyzed in order to develop a predictive model to predict the probability of delinquency. Through univariate analysis, the raw data is cleaned up to get the analysis dataset, and randomly divided into two datasets, 60% is used for model development, and 40% is used for model validation. Through bivariate analysis, the variables with strong predictive power are detected. The model is developed with stepwise logistic regression. Kolmogorov-Smirnov (KS) is used to evaluate the predictive power of the independent variables. The higher the KS, the higher the predictive power is. The project work is comprised of three parts. The first part is to use one year data (year 2005, 49,999 observations) to develop and validate the model. KS is 31.06 for model development, and KS is 30.97 for model validation, indicating the model has good separation power and robust. The predictive model is further validated by an overall evaluation of the model, statistical tests of individual predictors, goodness-of-fit statistics, and an assessment of the predicted probabilities. The second part is to use 6 years data (year 2005 to 2010, 300,000 observations) to develop a model. KS of the model is 40.68. This model is considered the base model. The third part is to improve the base model with macroeconomic indicators, including GDP, unemployment rate, consumer confidence index, and inflation rate. The macroeconomic indicators of year 2005 to 2010 were merged with the raw data of the

same time frame to form the combined dataset. The combined dataset is cleaned up to get the analysis dataset, and split into two datasets, 60% is used for model development, and 40% is used for model validation. KS for model development is 43.83, indicating an improvement over the base model, and KS for model validation is 44.00, indicating the model has good separation power, robust, and stable. This model can be implemented by financial institutions and a timer can be set up to run automatically in order to detect the high risk accounts in early stage and to prevent financial loss.

ID311 Mirko Kuck (University of Bremen) - *Automated Forecasting of Univariate Time Series Based on Classification and Combination*, co-author:
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Abstract: In several cases of real-world applications, large numbers of time series have to be predicted simultaneously. For instance, manufacturing companies selling various different products have to forecast future customer demands in order to achieve a well-founded production planning. Frequently, there either is a lack of expert knowledge to select and configure appropriate forecasting methods according to the different time series evolutions or there is a lack of time to regard each time series in detail. Hence, automated forecasting methods are needed, which automatically select an appropriate method and configure its parameters according to a specific time series evolution. This paper describes a novel approach for automated forecasting of univariate time series based on classification and forecast combination. An application to time series of the M3 competition is shown and the forecasting accuracy of the proposed approach is compared to those of established methods for univariate time series forecasting.

ID304   Nikoletta Zampeta Legaki (National Technical University of Athens) *Prototyping Forecasting e-Learning Platform*, Co-authors: Axilleas Raptis, National Technical University of Athens; Konstantinos Nikolopoulos, Bangor Business School
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Abstract: Risk and uncertainty accompany everyday life. Therefore, forecasting is a great aspect of a wide range of sectors such as business word (demand, finance, marketing, inventory), technology, healthcare, energy, tourism, transportation, environment, fashion, climate, sports and others. Due to the variety of all these sectors, a lot of forecasting methods from time series and causal / econometric forecasting methods to judgmental and artificial intelligence methods or even normative forecasting methods have been developed. The selection of the suitable forecasting method depends on the constraints and specifications which determine each problem. However, the rapid evolution of technology and telecommunication in conjunction with the wide outspread of internet enhance the access to a wealth of data and information about forecasting applications, provoking confusion to non – forecasters. Considering the above, this study aims at prototyping an e – learning Educational Platform about Forecasting based on an open source free platform. This platform will contribute to an effective online teaching and learning experience in a collaborative, private environment using high – end technology and trends. Finally, both the steps of the development and perspectives concerning the content will be described.

MBD6   Neural networks I

Date: Tuesday July 1, 3:00-4:00pm
Venue: Van Rijckevorsel
Chair: Roberto Morales-Arsenal (CUNEF)

ID97 Ali Babikir (University of KwaZulu-Natal) - *Factor Augmented Artificial Neural Network Model*, co-author: Henry Mwambi, University of KwaZulu-Natal

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Abstract: This paper brings together two important developments in forecasting literature; the artificial neural networks (ANNs) and factor models. The paper introduces the Factor Augmented Artificial Neural Network (FAANN) in order to produce a more accurate forecasting. The model is applied to forecasting three variables using large South African monthly panel. The out-of-sample root mean square error (RMSE) results show that the FAANN model yield substantial improvements over autoregressive AR benchmark model and standard dynamic factor model (DFM). The Diebold-Mariano test results confirm the superiority of the FAANN model forecasts performance over the AR benchmark model and the DFM model forecasts. The superiority of the FAANN is due to the ANN flexibility to account for potentially complex nonlinear relationships that are not easily captured by linear models.

ID146 Serkan Aras (Dokuz Eylul University) - *An Empirical Comparison of MLP, NEAT and Combined Forecast in Nonlinear Time Series*, co-authors: Anh Nguyen, University of Birmingham; Allan White, University of Birmingham; Shan He, University of Birmingham

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Abstract: The first objective of this paper was to apply NeuroEvolution of Augmenting Topologies (NEAT) to time series forecasting and to compare the resulting performance with the well-known feedforward Multilayer Perceptron (MLP). The second objective was to evaluate the performance of various pairwise combinations of these techniques. Broadly speaking, the results suggested that the NEAT algorithm produced superior forecasting performance, possibly because of its greater resistance to getting trapped in local minima. The results from combining forecasts led to better prediction than using single forecasts, whichever algorithm was used. The results also showed that even better forecasts were obtained by pairwise combination of the MLP and NEAT forecasts. Suggestions for further research are included.

ID315 Roberto Morales-Arsenal (CUNEF) - *Black Swans, Uncertainty and Big Data*

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Abstract: The Network society in which everything (internet of things) and everyone is connected has produced a massive increase in the amounts and types of data available to decision makers (individuals, firms or governments). Each day, 2000 bytes are generated around the world using electronic devices. Big Data is an inter-disciplinary field among computer science, statistics and mathematics. Big Data is the ability to store, to process and to analyze massive and unstructured quantities of data, that is to say, the ability to indentify underlaying patterns in the data in order to improve the decision makimg propcess. We propose two research paths. The first is about point forecast. For this task, we propose Big Data Neural Networks and secondly we propose the constrution of a Big Data Real-time indicator in order to establish the situation of economic trends.

MBD7   Neural networks II
Date: Tuesday July 1, 4:30-5:30pm
Venue: Van Rijckevorsel
Chair: Pasi Halmari (HAAGA-HELIA University of Applied Sciences)

ID294   Shu-Hao Yeh (University of Taipei) - *Corporate Default Prediction via Deep Learning*, Co-authors: Chuan-Ju Wang, University of Taipei; Ming-Feng Tsai, National Chengchi University
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Abstract: Corporate default prediction has been becoming more and more important in finance, especially after the financial crisis in 2007–2008. In literature, there are three major types of approaches to dealing with default prediction: classical statistical models, market-based models, and machine learning models. The classical statistical models, such as Altman's Model, Z-Score (1968) and Ohlson's O Score (1980), adopt the empirical analysis on historical market information for the prediction. The market-based models, such as the KMV-Merton Model, predict default risk by combining a company's capital structure and the market value of its assets. Different from statistical models, the machine learning models are non-parametric techniques for the prediction, so they can overcome the constraints within the traditional statistical models. In this paper, we focus on the machine learning models. There have been several machine learning algorithms regarding the default prediction problem as a classification problem, such as Support Vector Machines (SVM) and Artificial Neural Network (ANN). In general, such traditional machine learning algorithms need to explicitly extract factors as features, such as the 10-day moving average for a stock, for representing data. However, it is usually difficult to systematically extract these features or to obtain all the representable factors. Deep learning, also called representation learning, is a new area of Machine Learning research. Various deep learning algorithms have been applied in many fields, such as computer vision and automatic signal recognition. The concept of deep learning is about learning multiple levels of representation of data. For the learned representation, the lower-level features represent basic elements or edges in smaller area of data, whereas the higher-level features represent the abstract aspects of information within data. This paper attempts to provide a new perspective on the default prediction problem using deep learning algorithms. By leveraging the advantages of deep learning, the representable factors of input data will no longer need to be explicitly extracted but can be implicitly learned by the learning algorithms. We consider the stock returns of both default and solvent companies as input signals (which can be either a set of numerical signals or a picture) and use the Restricted Boltzmann Machine (RBM) and Deep Belief Networks (DBN) to train the prediction models. In the experiments, we conduct experiments using a collection of daily stock returns of American publicly-traded companies from 2001 to 2011. The 30-day and 180-day prior to default returns will be used as input signals for the learning algorithms. We expect that in our experiments, the deep learning algorithms can perform better than traditionally machine learning algorithms. More importantly, the representation of data can be automatically generated during the learning process. As a result, as direction for further research, it is important to identify and analyze the representation of the input signals.

ID300 Fahad Al-Qahtani (Lancaster University) - *Active Sampling for Time Series Prediction: Selecting the most informative Training Data for Forecasting UK Electricity Load with Neural Network*, co-author: Sven Crone, Lancaster University

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Abstract: One of the critical problems we often face in forecasting high frequency time series with Neural Network is the large possible amount of training data. Using all available data for training in this case can be computationally expensive and increase training time significantly. At the same time, increasing training data does not necessarily guarantee an increase in the generalization capability of the forecasting model especially for high frequency time series which often tend to have redundant data and depict some forms of seasonality. Previous studies have shown that selecting most informative data rather than selecting all data for training could be sufficient and lead to a good generalization performance of the model and reduce the required training time considerably. Nevertheless, the criteria of selecting such informative training datasets have not been extensively studied in the domain of time series forecasting. In this study, we propose the utilization of Active Sampling techniques in selecting the most informative subset of high frequency time series data for training Neural Network forecasting models. Hourly electrical demand time series is used in our experiment to examine this effect and Neural Network is selected as the primary forecasting model. Results of the experiment are reported and compared with conventional methods of training that alternatively consider all data. The training time and generalization accuracy of the forecasting models are used as evaluation criteria.

ID225 Pasi Halmari (HAAGA-HELIA University of Applied Sciences) - *Forecasting automobile sales with neural networks*

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Abstract: We address issues pertaining to heuristic and statistical purchase information in the automobile industry with emphasis on converting data into knowledge with neural networks combined with genetic algorithm. A neural network based on macro-economic variables is trained with a backpropagation learning algorithm. A genetic algorithm is used to define and refine the neural network model from a large number of macro-economic variables before the training with backpropagation learning algorithm. The rapid fluctuations during the past decade in the Finnish economy have made it difficult to forecast changes in sales with traditional methods. Our results show that a neural network combined with genetic algorithm is a promising method for use in highly volatile situations. We used market information and information on past economic development to automate the forecasting and thus to develop a heuristic tool. We also discuss the need of retraining and modification over the neural network model due to changes of consumer buying behavior over time.

EGY1   Probabilistic energy forecasting

Date: Monday June 30, 10:00-11:00am
Chair: Jooyoung Jeon (University of Bath)

ID281 Virginie Dordonnat (EDF R&D) - *Generating consistent weather-related scenarios in electricity generation for risk management*, co-authors: Jerome Collet, EDF R&D; Cherryl Dias, EDF R&D **E-mail**: virginie.dordonnat@edf.fr
Abstract: Electricite de France (EDF) is the major competitor in the French electricity market. The company produces and sells electricity to other market participants as well as to end-use customers and therefore manages uncertainties related to both electricity production and demand. Most uncertainties are related to future weather conditions. For the short-term horizon, ensemble forecasts from meteorological models are used. For further horizons, we generate paths from statistical models estimated on historical data. We will present our different models and how we can connect the different horizons using Ensemble copula coupling. We will also present how to evaluate our simulations.

ID89   Soraida Aguilar Vargas (Pontifícia Universidade Católica do Rio de Janeiro) - *Probabilistic forecasting of the wind power generation using kernel density estimation*, Co-authors: Reinaldo Souza, Pontifícia Universidade Católica do Rio de Janeiro; Jose Francisco Pessanha, Universidade do Estado do Rio de Janeiro
E-mail: saguilar@ele.puc-rio.br
Abstract: Wind energy is one of the renewable source with fastest growing in the world, requiring thus much more accurate forecasts in the decision-making process fpr short-term system operation. The uncertainty associated with the wind has been treated using several statistical techniques to produce forecasts at various lead-times. The technical literature reports that point forecasts, which is a deterministic forecasts, is the major approach employed. On the other hand, probabilistic forecasting is gaining greater acceptance due to its ability to incorporate the uncertainty in the modelling process This is a going on paper, that uses density kernel estimation to compute the complete predictive probability density function (PDF) for any lead-time, conditioned on the future value of the wind speed. For such wind speed forecast, it is necessary to fit a model. Once this model has been fitted, it is used to forecast different steps-ahead of the wind speed. To check the complete wind power generation model, in this paper it was fitted a straight forward parametric model to forecast the wind speed; however, other possibilities to model this explanatory variable will be tested.

ID305 Jooyoung Jeon (University of Bath) - *A Review and Comparison of GARCH Models for Wind Energy and Wave Height Forecasting*, co-author: James Taylor, University of Oxford **E-mail**: j.jeon@bath.ac.uk
Abstract: Wind speed density forecasts are crucial for maximising the utilisation of wind energy. We consider time series models for the density forecasting of hourly wind speed observations up to three days ahead. Building such models is challenging, because wind speed typically possesses diurnal and annual seasonality, non-Gaussianity, non-stationarity, short-term autocorrelation in the level and volatility, and long-memory temporal dependence. We consider a variety of seasonal ARMA-GARCH models, including bivariate formulations, accounting for both wind speed and direction. This joint modelling can improve wind speed forecasting, and is also motivated by the potential usefulness of wind direction forecasts for wind power prediction. We consider Box-Cox transformations, as well as Student t and skewed t distributions. To address long-memory, we incorporate fractional integration. Using Spanish and Greek wind farm data, we evaluate wind speed and direction density forecasts, as well as the resulting wind power density forecasts, produced using conditional kernel density estimation. Using Fino data, wind speed forecasts as well as wave height forecasts are evaluated.

EGY2   Electricity demand I
Date: Monday June 30, 3:00-4:00pm
Venue: Schadee
Chair: Ondrej Konar (Institute of Computer Science AS CR)

ID48 Caston Sigauke (University of the Witswatersrand) - *A Markov chain analysis of daily changes to peak electricity demand in South Africa*, Co-author: Delson Chikobvu, University of the Free State
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Abstract: Electricity demand exhibit fast changes and a large degree of randomness, whose description requires a detailed analysis using stochastic processes. The paper presents a Markov chain analysis to determine stationary distributions (steady state probabilities) of large daily changes in peak electricity demand. Such large changes pose challenges to system operators in the scheduling and dispatching of electrical energy to consumers. These large changes are usually due to extreme weather conditions. Using South African daily peak electricity demand data for the period 2000 to 2011 we develop a two-state discrete time Markov chain modelling framework to estimate steady-state probabilities of the two states which are positive daily changes (increases) and negative daily changes (decreases). We extend this to a four state Markov chain by defining two more states, small positive change and extreme positive change. Similarly for the negative changes we have small and extreme negative changes. Empirical results show that the steady state probabilities for a decrease and an increase are 0.5978 and 0.4022 respectively while those of the four state problem are 0.3789, 0.0234; 0.5443 and 0.0532 respectively. Such an analysis is important for planning, load shifting, load ow analysis and scheduling of electricity particularly during peak periods.

ID167 Kayoung Kim (Yonsei University) - *The failure of electric power demand forecasting in South Korea: The cause, its effects, and the direction of improvement*, co-author: Youngsang Cho, Yonsei University
E-mail: kytkim@yonsei.ac.kr

Abstract: The government of South Korea forecasted national energy demand by energy source when establishing the National Basic Plan for Energy (2011-2030) in 2008. However, the unplanned blackout occurred in 2011 due to the imbalance of electricity demand and supply in South Korea, so the balance of supply and demand of electricity became an important issue. Although the government is putting more efforts to secure electricity by expanding the supply capacity and controlling the demand, South Korea is still facing a risk of blackout due to the rapid electrification. In this circumstance, we attempt to investigate the inherent problems of the electricity forecasting system and process, and to find the factors of the difference between the forecasted electricity demand and actual demand in South Korea. Currently, KEEI-EGM model is used for electricity supply and demand forecasting in South Korea, which is the modification of NEMS (National Energy Modeling System) of U.S. Energy Information Administration (EIA). However, the detail information of forecasting methodology and related data are not opened to the public. In addition, government determines electricity price lower than other energy resources, such as gas, oil, and etc., aiming to improve industrial competitiveness and price stability by policy. We think that this energy pricing policy accelerates electrification and caused supply and demand imbalance of South Korea. Moreover, the current model does not reflect the relative price and elasticity of substitution among energy sources, and conversion demand, which are regarded as the main reasons of failure in electricity demand forecasting. In this study, focusing on the energy forecasting model used in South Korea and relative price of energies that causes conversion demand, the

implications to improve the accuracy of electricity demand forecasting for the South Korea are proposed.

ID243 Ondrej Konar (Institute of Computer Science AS CR) - *Forecasting the number of natural gas consumers and their total consumptions according to the tariff*, co-author: Marek Brabec, Institute of Computer Science AS CR
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Abstract: We will present a statistical model for forecasting the total number of energy consumers and their total annual consumption according to predefined tariff classes. We primarily focus on the natural gas consumers, but the presented methods can be, with little modifications, used for electricity consumers as well. Compared to the standard time series forecasting, our task is complicated by the presence of dependency structure between the forecast quantities across the tariff classes. This dependence is a consequence of customer migration between the classes. Another complication is the nature of the input data, which don't have the uniform temporal resolution. Instead, the data are differently time-aggregated for each customer. Presented model has two levels. The number of customers is forecast in the first step and then it is multiplied by the average consumption in the respective tariff class. The forecast is based on the (non-homogeneous) Markov chain framework. The transition probabilities are estimated empirically using the transformed billing data. The data transformation algorithm is also described. The forecast error was evaluated using the real billing data provided by a natural gas distribution company. The non-negligible reduction of forecast error compared to the current state, i.e., the expert forecast, is observed.

EGY3   Electricity demand II

Date: Monday June 30, 4:30-5:30pm
Venue: Schadee
Chair: Tao Hong (University of North Carolina at Charlotte)

ID216 Reinaldo Souza (Pontifícia Universidade Católica do Rio de Janeiro) - Long-term electricity demand forecast by fuzzy logic approach, co-authors:

Fabiano Torrini, PUC-Rio; Fernando Cyrino, PUC-Rio
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Abstract: The consumption of electricity in Brazil has been widely discussed recently. With the crisis of energy supply in 2001, the Federal Government was forced to take a series of measures to try to fix the actual model and to ensure greater stability in the electricity system supply. In this context, energy companies are facing the challenge of making more accurate load forecasts. Consequently, once this need is inserted into a scenario of unstable economy, these estimates require efficient methods combined with innovative features. The aim of this study is to provide a new approach to this electricity prediction problem. A Fuzzy logic methodology is proposed in order to extract rules from the input variables and provide Brazil's Long-term annual electricity demand forecasts. From a statistical modeling point of view, an identification of dependence and lags structure between the input variables provide support for independent models with annual estimates. Once the forecasts are obtained by the fuzzy logic system, they are disaggregated into monthly estimates, through seasonal factors generated by time series analysis procedures and load levels. The advantage of the fuzzy logic model lies on the ability to mimic the human thinking in an environment of uncertainty and imprecision. In recent literature, the formulation of these types of models has been limited to treating the explanatory variables in the univariate form, involving only the GDP. This study proposes an extension of this model, starting with the Brazilian population and the additional value of the state GDP by sectors with their variations. Then, the proposed model is compared with the existent econometric formulation.

ID341   Sahm Kim (Chung Ang University) - Forecasting on Daily Peak Load Electricity Demand in South Korea using Seasonal GARCH Models

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Abstract: Accurate and reliable electricity demand forecasting can provide a promising basis to construct reasonable plans for building and managing power plants as well as the enhancement of the satisfaction of the customers. Demand forecasting on electricity in South Korea has fundamental reasons to be considered deeply. Timely and early warning of an unexpected increase in electricity demand is important to ensure the security of the supply processes in electricity industries. This paper proposes seasonal autoregressive-generalized autoregressive conditional heteroscedasticity (Seasonal-AR-GARCH) models for forecasting daily peak load. In these models, we first apply hourly data and daily peak data between 2009 and 2013 years in South Korea. And we also take into account the seasonal patterns on the weekends, national holidays and other special days in the models. Special considerations are focused on the weather variables especially temperature on summer and winter times. We evaluate the performance of the proposed models by comparing them with several competing models such as seasonal autoregressive integrated moving average (SARIMA) , Holt-Winters(Taylor) and Fractional ARIMA(FRIMA) models in terms of the root mean square error (RMSE) and the mean absolute percentage error(MAPE) criteria.

ID268 Tao Hong (University of North Carolina at Charlotte) - *Global Energy Forecasting Competition: Past, Present and Future*

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Abstract: Forecasting plays a vital role in the energy industry. Every year, the scientific community publishes thousands of papers on the subjects of electricity demand, generation and price forecasting. Most of them are irreproducible and thus difficult for continuous research with solid comparative studies. Forecasting competition is a good way to bring together novel ideas and to recognize effective methods given comparisons on the same datasets. The first Global Energy Forecasting Competition (GEFCom) was held in 2012, which included two tracks, hierarchical load forecasting and wind solar forecasting. The next GEFCom will be launched in fall of 2014, which will include four tracks: electric load forecasting; electricity price forecasting, wind power forecasting and solar power forecasting. The theme of GEFCom2014 is probabilistic energy forecasting. This presentation will discuss lessons learned from GEFCom2012, offer a preview of GEFCom2014, and open the dialog to the future energy forecasting competitions.

EGY4   Oil prices
Date: Tuesday July 1, 10:00-11:00am
Chair: Pierre Guerin (Bank of Canada)

ID21 Caston Sigauke (University of the Witwatersrand) - *A probabilistic characterization of daily and day to day changes in peak electricity demand*, co-author: Delson Chikobvu, University of the Free State
E-mail: caston.sigauke2@wits.ac.za
Abstract: Large daily and day to day changes in peak electricity demand pose challenges to system operators in the scheduling and dispatching of electrical energy to consumers. These large changes are usually due to extreme weather conditions. A three-state Markov chain modelling framework is used in this paper to estimate steady-state probabilities of the three states which are positive daily change (increase), negative daily change (decrease) and no change.

ID274 Xun Zhang (Academy of Mathematics and Systems Science) - *How Does Investor Attention Influence Crude Oil Prices? New Evidence from Google Search Volume Index*, co-authors: Xin Li, Chinese Academy of Sciences; Shouyang Wang, Chinese Academy of Sciences
E-mail: zhangxun@amss.ac.cn
Abstract: Investor attention is a newly emerging concept which can be viewed as a crucial factor on fluctuations of crude oil prices in recent literature. However, the unobservable characteristics of investor attention restrict its use in quantitative analysis. This paper utilizes Google search volume index (GSVI), a kind of Internet-based data to measure some investors' attention in crude oil market. The empirical results indicate that GSVI captures the attention of some speculators like noncommercial and non-reporting traders, instead of commercial traders, and verify the bi-directional influence between investor attention crude oil prices using a multivariate VAR model. Furthermore, GSVI improves crude oil price forecasting accuracy according to recursive out-of-sample forecasts. This paper provides a new perspective on incorporating Internet-based data into the analysis and prediction of crude oil prices in the Big Data Era.

ID15 Pierre Guerin (Bank of Canada) - *Do High-Frequency Financial Data Help Forecast Oil Prices? The MIDAS Touch at Work*, co-authors: Christiane Baumeister, Bank of Canada; Lutz Killian, University of Michigan
E-mail: pguerin@bankofcanada.ca
Abstract: In recent years there has been increased interest in the link between financial markets and oil markets, including the question of whether financial market information helps forecast the real price of oil in physical markets. An obvious advantage of financial data in forecasting monthly oil prices is their availability in real time on a daily or weekly basis. We investigate the predictive content of these data using mixed-frequency models. We show that, among a range of alternative high-frequency predictors, cumulative changes in U.S. crude oil inventories in particular produce substantial and statistically significant real-time improvements in forecast accuracy. The preferred MIDAS model reduces the MSPE by as much as 16 percent compared with the no-change forecast and has statistically significant directional accuracy as high as 80 percent. This MIDAS forecast also is more accurate than a mixed-frequency real-time VAR forecast, but not systematically more accurate than the corresponding forecast based on monthly inventories. We conclude that typically not much is lost by ignoring high-frequency financial data in forecasting the monthly real price of oil.

FIN1   Analysts' forecasts
Date: Monday June 30, 10:00-11:00am
Venue: Van Beuningen
Chair: Dan Zhu (Bangor Business School)

ID240 Choong-Yuel Yoo (Korea Advanced Institute of Science and Technology)
Do Analysts Strategically Employ Cash Flow Forecasts Revisions to Offset Negative Earnings Forecasts Revisions?, Co-Authors: Jinha Pae, Korea University; Steven E. Salterio, Queen's University in Kingston
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Abstract: This study investigates whether analysts use cash flow forecast revisions as a means of reducing the impact of earnings forecast revisions on market participants. To obtain maximum power, we focus on analysts' concurrent cash flow and earnings forecast revisions that are in the opposite direction from each other. We posit that analysts' decisions to strategically provide a concurrent cash flow forecast are, at least in part, dependent on the positive or negative news in their earnings forecast revision. We start by carrying out an interview-based field study with analysts. These analysts testified that they prioritized finding and reporting positive offsetting information, including cash flow forecast revisions, when they issued negative earnings forecasts. We then carry out a large scale archival investigation to determine if this evidence of strategic forecast usage generalizes to the market level. Specifically, we examine whether concurrent positive cash flow forecast revisions are released with negative earnings forecast revisions more often than the opposite combination. We find that analysts are significantly more likely to issue concurrent positive cash flow forecast revisions when earnings forecast revisions are negative (than the opposite) in the larger complex firms that make up Fortune 500 consistent with the need of analysts to maintain access to management. Furthermore, amongst the smaller firms that analysts can more readily drop coverage with ongoing bad earnings news, the same results are not obtained. Finally, we examine the rationales provided in the analyst full-text reports and find that analysts attribute their opposite direction cash flow forecast revisions to changes in their forecasting model's assumption that would be difficult for an analyst to make without having access to management. Overall the pattern of evidence suggests that analysts use cash flow forecasts in conjunction with earnings forecasts to strategically influence market participants.

ID290 Bert de Bruijn (Erasmus University Rotterdam) - How informative are earnings forecasts? , co-author: Philip Hans Franses, Erasmus Universiteit Rotterdam
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Abstract: We construct forecasts of earnings forecasts using data on 406 firms and forecasts made by 5419 individuals with on average 25 forecasts per individual. We verify previously found predictors, which are the average of the most recent available forecast for each forecaster and the difference between the average and the forecast that this forecaster previously made. We extend the knowledge base by analyzing the unpredictable component of the earnings forecast. We find that for some forecasters the unpredictable component can be used to improve upon the predictable forecast, but we also find that this property is not persistent over time. Hence, a user of the forecasts cannot trust that the forecaster will remain to be of forecasting value. We find that in general the larger is the unpredictable component, the larger is the forecast error, while small unpredictable components can lead to gains in forecast accuracy. Based on our results, we formulate the following practical guidelines for investors: (i) for earnings analysts themselves, it seems to be the safest to not make large adjustments to the predictable forecast, unless one is very confident about the additional information, and (ii) for users of earnings forecasts, it seems best to only use those forecasts that do not differ much from their predicted values.

ID378   Dan Zhu (Bangor Business School) - *Academic Performance and Financial Performance: an Experimental Study*, Co-Authors: Lynn Hodgkinson, Bangor Business School; Qingwei Wang, Bangor Business School

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Abstract: In an experimental study of forecasting stock prices over 13 months, we find worse academic performance is significantly associated with larger absolute forecasting errors, wider prediction intervals and a higher propensity to be overconfident. The inferior performance of financial forecasting among worse academic performers provides a possible explanation for the market participation puzzle. The results are robust to inclusion of controls for personal characteristics, finance education background, investment experience, stock price features, and unobserved individual effect.

FIN2   Crises and crashes
Date: Monday June 30, 11:25am-12:45pm
Venue: Van Beuningen
Chair: Jeroen Rombouts (ESSEC Business School)

ID330 Francine Gresnigt (Erasmus University Rotterdam) – *Interpreting financial market crashes as earth quakes: A new early warning system for medium-term crashes*, Co-authors: Erik Kole, Erasmus University Rotterdam; Philip Hans Franses, Erasmus University Rotterdam
E-mail: gresnigt@ese.eur.nl
Abstract: We propose a modeling framework which allows for creating probability predictions on a future market crash in the medium-term, like sometime in the next five days. Our framework draws upon noticeable similarities between stock returns around a financial market crash and seismic activity around earth quakes. Our model is incorporated in an Early Warning System for future crash days, and it is implemented in investment strategies. Testing our warning system on S&P 500 data during the recent financial crisis, we find positive Hanssen-Kuiper Skill Scores, and also, our investment strategies to have higher Sharpe ratios than the benchmark strategies over the same period.

ID333 Saverio Simonelli (University of Naples Federico II and CSEF) – *Nowcasting and Financial Markets: How Markets react to Macroeconomic News*, co-authors: Domenico Giannone, LUISS University of Rome; Lucrezia Reichlin, London Business School
E-mail: savsimon@unina.it
Abstract: This paper studies the effects of scheduled macroeconomics news on financial markets. The analysis is conducted by investigating the response of U.S. bond and stock markets to macroeconomics news generated by a nowcasting model for the U.S. real economy. Namely, the news are estimated by the difference between the realisations and what had been forecast by the model before the releases. Indeed, a nowcasting model, as the one proposed by Giannone, Reichlin, and Small (2008), allows to interpret various data releases in terms of the signal they provide on current economic conditions, therefore it allows to compute, for each data release, a model based surprise. Further, the nowcast model estimates the relevance of each news in signalling changes in economic activity that could be used for weighting the news when evaluating their impact on financial markets. In this paper, we estimate a fully real-time nowcasting model for US by constructing a real-time database of vintages from 2004 to 2013 for a panel of 17 monthly variables and the GDP, reproducing the exact information that was available on the day of any release. We find that both the equity and the stock market reacts to announcement surprises.

ID227 Stavroula Yfanti (Brunel University) - *Modelling Returns and Volatilities During Financial Crises: a Time Varying Coefficient Approach*, co-authors: Menelaos Karanasos, Brunel University; Alexandros Paraskevopoulos, Brunel University; Faek Menla Ali, Brunel University, Michail Karoglou, Aston Business School
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Abstract: We examine how the most prevalent stochastic properties of key financial time series have been affected during the recent financial crises. In particular we focus on changes associated with the remarkable economic events of the last two decades in

the mean and volatility dynamics, including the underlying volatility persistence and volatility spillovers structure. Using daily data from several key stock market indices we find that stock market returns exhibit time varying persistence in their corresponding conditional variances. Furthermore, the results of our bivariate GARCH models show the existence of time varying correlations as well as time varying shock and volatility spillovers between FTSE and DAX, and, NIKKEI and Hang Seng, which became more prominent during the recent financial crisis. Of independent interest is also our theoretical considerations on the time varying model which provides the platform upon which we integrate our multifaceted empirical approaches. In particular, we provide the general solution for low order time varying models specifications, which is a long standing research topic. This enables us to characterize these models by deriving, first, its multistep ahead predictor, second, the first two unconditional moments, and third, its covariance structure.

ID202 David Harvey (University of Nottingham) - *Improving the accuracy of asset price bubble start and end date estimators*, co-authors: Stephen Leybourne, University of Nottingham; Robert Sollis, Newcastle University
E-mail: dave.harvey@nottingham.ac.uk
Abstract: This paper proposes new methods for dating the beginning and end of an asset price bubble. In common with recent work on testing for a bubble, we adopt an autoregressive framework and model the bubble by an explosive autoregressive regime. A potential collapse is also permitted, modelled by a subsequent stationary autoregressive regime. The regime change points are estimated on the basis of minimising the sum of squared residuals across all candidate dates. It is important in practice to consider alternative models that allow for the bubble to run to the end of the sample, terminate in-sample, or collapse in-sample; for example, determining whether a bubble has terminated or is still exploding is critical for forecasting efforts. We therefore consider dating on the basis of a number of alternative bubble models, and propose a procedure for selecting between the models on the basis of an information criterion. The bubble start and end date estimators are shown to be consistent for the true regime change points, and the model selection method is shown to consistently identify the correct model. Monte Carlo simulations reveal good finite sample performance in relation to competing dating procedures.

FIN3   Credit risk
Date: Monday June 30, 3:00-4:00pm
Venue: Van Beuningen
Chair: Yi-Chen Lin (Tamkang University)

ID100 Ruey-Ching Hwang (National Dong Hwa University) - *Predicting recovery rates using the logistic quantile regression with bounded outcome*, co-author: Jhao-Siang Siao, National Dong Hwa University;
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Abstract: The logistic quantile regression (LQR) is used for studying recovery rates. It is developed using monotone transformations. Due to the fact that quantiles are invariant to monotone transformations, the inference on the quantile regression based on monotone transformed recovery rates is the same as that based on true recovery rates. However, the usual transformation regression is not invariant to monotone transformations since they are based on the mean regression. We illustrate LQR using real datasets based on the six predictors in Altman and Kalotay (2013). Using an expanding rolling window approach, the empirical results confirm that the proposed LQR using the data-based quantile point has better performance than the usual transformation regression, in the sense of yielding more accurate predicted recoveries on portfolios of defaulted debts on an out-of-sample basis. Thus, LQR is a useful alternative for studying recovery rates.

ID124   Katarzyna Bijak (University of Southampton) - *Performance measures of models to predict Loss Given Default: a critical review*
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Abstract: The need for quantitative models in banking is largely related to the Basel Accords and, in particular, to the Advanced Internal Ratings-Based (AIRB) approach. Under the AIRB approach, lenders are allowed to use their own predictions of risk parameters. The most important risk parameters are Probability of Default (PD) and Loss Given Default (LGD). LGD is the lender's loss on a loan due to the customer's default, i.e. failure to meet the credit commitment. Unlike with PD models, whose performance is almost always measured with the Gini coefficient or the Kolmogorov-Smirnov (KS) statistic, there are no standard performance measures of models to predict LGD. Currently, at least ten different performance measures are used. For the purpose of this review, they are classified as either error measures or non-error measures. Among the former are Mean Square Error (MSE), Mean Absolute Error (MAE) etc. The latter include e.g. coefficient of determination (R-squared) and correlation coefficients between the observed and predicted LGD. Understandably, the error measures should be relatively low in a good LGD model, whereas the non-error measures should be relatively high. The advantages and disadvantages of each measure are discussed. It is argued that R-squared should only be used to evaluate the performance of linear models, although it is commonly applied to all sorts of LGD models. Another popular measure is the Area Over the Regression Error Characteristic Curve (AOC), which can be defined twofold, depending on whether squared or absolute residuals are used. It is pointed out that AOC and MSE/MAE are practically identical even for reasonably small samples. Finally, the application of the Area Under the Receiver Operating Characteristic Curve (AUC) to LGD models is critically discussed. As LGD is represented by a continuous variable, AUC requires its arbitrary classification, e.g. below-the-mean and over-the-mean. An alternative is proposed that is free from this drawback. The review is illustrated with examples of evaluating the performance of some LGD models built on the data provided by a UK bank.

ID127 Yi-Chen Lin (Tamkang University) - *The relationship between capital gains and saving: evidence from smooth coefficient quantile regressions*, co-author: Wen-Shuenn, Tamkang University

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Abstract: The aim of this research is to reveal the heterogeneity across the extent of financial constraint and across quantiles of the household saving distribution in the effects of capital gains in corporate equities and real estates. We improve upon the extant literature by using a semiparametric smooth coefficient quantile regression approach to characterize the heterogeneous effects of capital gains across different points of the saving distribution. All the existing evidence is based on a mean regression approach. While average effects are important, however, from a policy perspective it is more relevant to examine whether an increase in, for example, housing capital gain is as important for people with the highest saving in a population as they are for people with the least saving? Our focus on the entire household saving distribution is partly motivated by the high skewness of the household saving distribution. When the underlying distribution of the dependent variable is heavily skewed, deriving implications from mean regressions is likely to yield misleading policies. The flexible semiparametric approach allows us to understand whether the covariate effects are constant across the entire distribution of the dependent variable and whether the covariate effects are dependent upon a mediating variable. This paper contributes to the literature by providing the first semiparametric quantile evidence on the marginal propensity to consume out of housing capital gain at the extremes of the household saving distribution. In addition, our empirical results will provide estimates of marginal propensity to save that is specific to the household's extent of borrowing constraint. Our results will provide basis for identifying households that have the strongest saving/consumption response to changes in house price and stock price and will shed new lights on the heterogeneity in the transmission mechanism of changes in house price and stock price.

FIN4   Financial instability I
Date: Monday June 30, 4:30-5:30pm
Chair: Claudio Antonini (AlixPartners)

ID196 Roberto Panzica (Goethe Universität House of Finance) - *Systemic and systematic risk in stock returns*, co-authors: Monica Billio, University of Venice; Massimiliano Caporin, University of Padua; Loriana Pelizzon, University of Venice
E-mail: panzica@safe.uni-frankfurt.de
Abstract: The need for understanding the propagation mechanisms behind the recent financial crises lead the increased interest for works associated with systemic risks. In this framework, network-based methods have been used to infer from data the linkages between institutions (or companies). Part of the literature postulates that systemic risk is strictly related (if not equal to) systematic risk. In this work, we elaborate on this hypothesis and introduce a modeling framework where systemic and systematic risks co-exist. The model is a variation of the traditional CAPM where networks are used to infer the exogenous and contemporaneous links across assets. The systematic risk component acts in an additive way on both the systematic and idiosyncratic risk components. Our proposed methodology is verified both on simulations as well as on real data.

ID306 Laura Carabotta (Universitat de Barcelona) - *How to improve fiscal accuracy? A combination of private and public forecasts deficit in Italy*, co-author: Peter Claeys, Universitat de Barcelona
E-mail: laura_carabotta@yahoo.it
Abstract: In the last two decades many agencies try to find out the best model to forecast fiscal variables. One way to make these models more accurate is through their combination. The objective of this paper is to apply techniques of combining fiscal forecasts of the deficit to GDP ratio for Italy that have been produced by national (public and private) and international institutes in the period 1993-2012. We conclude: 1) the accuracy of the forecasts indeed improves; 2) the performance of this combination is superior to a simple AR model 3) testing predictive accuracy and testing fluctuation of the time series, show the relative predictive abilities of forecasting models and combination models in total.

ID337 Harald Schmidbauer (Istanbul Bilgi University) - *Aggregation of return-to-volatility spillovers in networks of financial markets*, co-author: Angi Roesch, FOM University of Applied Sciences
E-mail: harald@hs-stat.com
Abstract: What share of volatility observed in an equity market is due to return spillovers from other markets? The benefits of discussing this question within the framework of fevd (forecast error variance decomposition) based spillover matrices are that (i) it allows for daily updates, (ii) it lends itself to an interpretation as network with markets as nodes and spillovers quantifying the weight of edges. Consider a network of international equity markets, and suppose that its nodes belong to distinct groups, for example, the EU and BRIC (Brazil, Russia, India, China), and the goal is to determine group-specific spillovers to another market, for example Turkey. Simply adding up spillovers for each group will lead to biased results if the groups have different numbers of members. This problem can be resolved by adequately summarizing the news originating from each group in the network and assessing the impact of this news

summary on volatility. We present an algorithm which extracts group-specific news and provides the necessary input in order to obtain spillover matrices and a fair assessment of news-to-volatility spillovers, also in the case of different group sizes. This approach preserves the benefits of the network perspective. We show examples of structural changes in networks of financial markets, which can be related to recent political developments.

FIN5   Financial instability II
Date: Tuesday July 1, 10:00-11:00am
Venue: Van Beuningen
Chair: Claudio Antonini (AlixPartners)

ID308 Peter Sarlin (Goethe University Frankfurt) - *Macroprudential oversight, risk communication and visualization*
E-mail: psarlin@abo.fi

Abstract: This paper discusses the role of risk communication in macroprudential oversight and of visualization in risk communication. While broad and effective communication of timely information related to systemic risks is a key mandate of macroprudential supervisors, the soar in data availability and precision further stresses the importance of simple representations of complex data. Risk communication comprises two tasks: disseminating information about systemic risks internally and externally. This paper focuses on the background and theory of information visualization and visual analytics, as well as techniques provided within these fields, as potential means for risk communication. We define the task of visualization in internal and external risk communication, and provide a discussion of the type of available macroprudential data and an overview of visualization techniques applied to systemic risk. We conclude that two essential, yet rare, features for supporting the analysis of big data and communication of risks are analytical visualizations and interactive interfaces. This is illustrated in the present paper with implementations of three analytical visualizations and five web-based interactive visualizations to systemic risk indicators and models.

ID336 Angi Roesch (FOM University of Applied Sciences) - *Information flow and entropy in networks of financial markets*, co-author: Harald Schmidbauer, Istanbul Bilgi University
E-mail: angi@angi-stat.com

Abstract: Financial markets can be seen as nodes in a directed network with sophisticated edge weights quantifying news-to-volatility spillovers in terms of forecast error variance decompositions (fevds) of daily returns on their equity prices. Several market connectedness measures which turned out to be closely related to concepts of network connectedness have been proposed, including an average connectedness index, to provide an assessment of systemic risk. Transformation of the adjacency matrix into the transition matrix of a Markov process running forward in time enables us to monitor information-theoretic aspects of the network's dynamics. A day-to-day perspective leads us to measure the amount of information injected into the network of markets on a daily basis, which we refer to as the relative market entropy. From a within-day perspective, the rate at which information is generated and digested can be quantified, which translates into a timely assessment of network stability. Comparison of this dynamical entropy per unit time to its time-reversed analogue provides a measure of the information flow's irreversibility and hence of the information asymmetry among markets. Analyzing a network of equity markets, we demonstrate that increasing trends in connectedness as well as in speed of information digestion are an empirical fact but no logical necessity.

ID307 Claudio Antonini (AlixPartners) - *Tracking and Predicting Financial Crises through Data Mining*

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Abstract: An indication of the level of the 2007-2009 financial crisis is that not even the magnitude of the losses are known -- the errors in estimating them are larger than the GDP of most countries. Piecemeal regulations, designed to help from small departures from equilibrium, were ineffective in containing rapid disturbances propagating through the financial system, some even saying that they contributed to the problem due to their inability to look sideways. In parallel, international organizations and central banks have been applying networking-related concepts to evaluate the stability of the financial system, its departure from equilibrium (through the Kullback-Leibler distance), and how to relate these concepts to macroeconomic variables to track down the origin, location, and level of disturbances in real-time. The most promising research stems from the calculation of spillover indices through the variance decomposition of stock or index price returns, volatilities, or CDS spreads. Given its generality, the technique can be applied to many other financial areas that can be represented as networks. We have developed a methodology marrying two separate streams and applied it to 17 major global financial market indices in the period 1992-2014. The technique calculates a spillover index (Koessler-Wagner) through robust variance decomposition and fits it using decision trees to macroeconomic variables that can be affected by policymakers (leverage, current account deficit, credit growth, ...). By combining these techniques, the process not only allows tracking the crisis, but lets determine validated ways to control it (validated because the model is based on an index constructed on real variables, not on postulated behavior). Developing a low-order model through data mining overcomes the intensive calculations limiting the application of the Koessler-Wagner methodology, which requires hours of processing even for a modest-size network of 20 banks or indices. Moreover, the control variables used in the low-order model are those studied by the Macroprudential Research Network of the European Central Bank (Sarlin-Peltonen), allowing a direct map to their Pre-Crisis, Crisis, Post-Crisis, and Tranquil states. Thus, we are in the position not only to track and control a crisis, but also to predict its course up to two years in advance.

FIN6   Volatility
Date: Tuesday July 1, 10:00-11:00am
Venue: Ruys
Chair: Jan G. de Gooijer (University of Amsterdam)

ID252 Alessandra Amendola (University of Salerno) - *Combining information at different frequencies in multivariate volatility prediction*, co-author: Giuseppe Storti, University of Salerno
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Abstract: In the last two decades the literature has been focusing on the development of dynamic models for predicting conditional covariance matrices from daily returns and, more recently, on the generation of conditional covariance forecasts by means of dynamic models directly fitted to realized measures. Despite the number of contributions on this topic same open issue still arise. First, are dynamic models based on realized measures able to produce more accurate forecasts than standard MGARCH models based on daily returns? Second, which is the impact of the choice of the volatility proxies on forecasting accuracy? Is it possible to improve the forecasts accuracy by combining forecasts from MGARCH and models for realized measures? Finally, combining information observed at different frequencies can help to improve over the performance of single models? In order to gain some insight about these research questions, in this paper we perform anextensive forecast comparison of different multivariate volatility models considering both MGARCH models and dynamic models for realized covariance measures. Furthermore, we investigate the possibility of increasing predictive accuracy by combining forecasts generated from these two classes of models, using different combination schemes and mixing forecasts based on information sets observed at different frequencies.

ID361 Rui Menezes (ISCTE-IUL & BRU-IUL) - *Stock market volatility changes in Europe: 1989-2014*
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Abstract: In this paper we analyze the behavior of stock market volatility between 1989 and 2014 using daily data. Since volatility can be seen as a risk measure in the market, we seek for structural breaks and regime shifts over the period, in particular between 2007 and 2010. We also seek for causality effects between long-run interest rates and stock market returns. Asymmetric information is also accounted for as well as changes in persistency before and after the recent succession of crises. Finally, we perform out-of-sample tests for assessing the forecasting capability of our models and how the crises affect such capabilities. The analysis is performed using daily data from a significant number of European countries including Eurozone and non-Eurozone countries. It is clear that the sovereign debt crises in Greece, Ireland and Portugal played an important role and quantifying these effects is an important task. Altogether, persistency increased dramatically from before to after the 2008 crisis across all Europe which may be an indicator that the European crisis is not yet completely controlled but also not out-of-control.

ID372 Cees Diks (University of Amsterdam) - *Comparing the Accuracy of Copula-Based Multivariate Density Forecasts in Selected Regions of Support*, co-authors: Valentyn Panchenko, Oleg Sokolinskiy

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Abstract: This paper develops a testing framework for comparing the predictive accuracy of copula-based multivariate density forecasts, focusing on a specific part of the joint distribution. The test is framed in the context of the Kullback-Leibler Information Criterion, and using (out-of-sample) conditional likelihood and censored likelihood in order to restrict the evaluation to the region of interest. Monte Carlo simulations show that the resulting test statistics have satisfactory size and power properties in small samples. In an empirical application to daily exchange rate returns we find evidence that the dependence structure varies with the sign and magnitude of returns, such that different parametric copula models achieve superior forecasting performance in different regions of the copula support. Our analysis highlights the importance of allowing for lower and upper tail dependence for accurate forecasting of common extreme appreciation and depreciation of different currencies.

FIN7   Foreign exchange and banking

Date: Tuesday July 1, 11:25am-12:45pm
Venue: Van Beuningen
Chair: Mikhail Mamonov (Center for Macroeconomic Analysis and Short-term Forecasting)

ID157 Chih-Chiang Wu (Yuan Ze University) - *The Asymmetry in Carry Trade and US Dollar*, co-author: Chang-Che Wu, Yuan Ze University
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Abstract: As noticed in Menkhoff, et al. (2012), Global FX volatility increase sharply during the financial crisis. Simultaneously, the carry trade returns suffer a huge loss in G10 and global market, and the US dollar becomes a relatively stability currency for carry trade investor. Our purpose is examining the cross-correlation and modeling the dependence structures among the carry trade for G10 and global market and US dollar exchange rate. We find that US dollar behave a safe haven for carry trade investor in the extreme market. We also show that the improvements of considering tail dependence, asymmetry, and time-varying dependence are statistically significant. Finally, we also provide the economic evidence for the feature of dependence structure in different relative risk aversion level and the skewed-t copula provide the most benefit in all models. Our finding provides the implication asset allocation and risk management for the carry trade investor.

ID314 Zsolt Darvas (Bruegel/Corvinus University/CERS HAS) – *Forecasting exchange rates of major currencies with long maturity forward rates*, co-author: Zoltan Schepp, University of Pecs
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Abstract: This paper presents unprecedented exchange rate forecasting results with a new model, an error correction model assuming that long-maturity forward rates are stationary. We assess the out-of-sample forecasting performance of our model for US dollar exchange rates against nine industrial countries' currencies, using the 1990-2006 and 1990-2013 periods for evaluating out-of-sample forecasts. In the pre-crisis period, our model outperforms the random walk for all currencies. Inclusion of the crisis in the out-of-sample period generally weakens our results, but they remain significant for about seven of the nine currencies and there are good reasons to believe that exchange rate and interest rate movements during the global financial and economic crisis were extraordinary. The improvement in forecast accuracy of our models is economically significant for most of the exchange rate series and statistically significant according to a bootstrap test. Our results are robust to the specification of the error correction model and to the underlying data frequency.

ID320 Christina Konstantinidou (National Technical University of Athens) *Forecasting the solvency of banking institutions*, co-authors: Pavlos Gkologiannis, National Technical University of Athens; Georgios Georgiadis, National Technical University of Athens; Vassilis Assimakopoulos, National Technical University of Athens
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Abstract: The interdependence of the world's economy and financial institutions, due to globalization and the recent increase of banking crises, lead to the need of forecasting models that could foresee banking failures in advance. In this research, we implement different forecasting models in order to investigate the solvency of 11 banks (5 European and 6 Greek). Through the different forecasting techniques (Naïve, Holt, Damped, SES,

THETA and NN) we compare the different models in order to find which method improves the forecasting accuracy how much is influenced from the various variables that we used. As variables, we used banking ratios related to the liquidity of financial institutions such as treasury bonds, loan/deposits, interbank deposits, NPL, as well as macroeconomic variables such as GNP, industrial price index, euro exchange rate etc. The forecasting accuracy of the models was evaluated with the use of error indicators. Conclusions were extracted based on these indicators. The main purpose of this study is to find which method improves the forecasting accuracy suggesting a promising hybrid model.

ID344 Mikhail Mamonov (Center for Macroeconomic Analysis and Short-term Forecasting) - *Bad Management, Skimping, or Both? The Relationship between Cost Efficiency and Loan Quality in Russian Banks*

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Abstract: This paper investigates the relationship between operating cost efficiency and the loan quality of Russian banks. It tries to answer the question whether it is always beneficial for banks to be highly cost efficient (the "bad management" hypothesis) or whether this higher cost efficiency could mean inadequate spending on borrower screening, which could subject banks to higher credit risk exposures in the future (the "skimping" hypothesis)? Our main result implies that, while the "bad management" hypothesis holds on average for the banking sector as a whole, the "skimping" hypothesis could be the case for those Russian banks that are not just highly cost efficient, as predicted by Berger and DeYoung (1997) for US banks, but that at the same time pursue aggressive strategies in the market for loans to households and non-financial firms, especially during the pre-crisis periods when banks are too optimistic to pay increased attention to the quality of borrowers in order to extract higher profits in the short run. Interestingly, we show that the "skimping" strategy is not the case for those Russian banks that demonstrate a lower equity-to-assets ratio and that are highly cost efficient at the same time because, as we believe, higher financial leverage forces these banks to filter out low quality borrowers to be able to repay borrowed funds. From perspective of regulatory policy, these conclusions provide clear arguments in favor of differential prudential regulation in Russia, which could, if being implemented, positively affect the loan quality of both banks that are skimpers (through restricting loans growth by higher capital adequacy requirements and/or increased payments to the Russian Deposit Insurance Agency) and banks that are not (through eliminating incentives to grow too fast), thus improving the stability of the banking sector as a whole.

FIN8   Volatility and downside risk
Date: Tuesday July 1, 11:25am-12:45pm
Venue: Ruys
Chair: Massimiliano Caporin (University of Padova)

ID88 Monica M.C. Weng (Graduate Institute of Statistics & Actuarial Science, Feng Chia University) - *Forecasting Value-at-Risk Based on Variant Smooth Transition Heteroskedastic Models*, co-authors: Cathy W.S. Chen, Feng Chia University; Toshiaki Watanabe, Hitotsubashi University
E-mail: monica.mc.weng@gmail.com
Abstract: Value-at-Risk (VaR) is a popular instrument for financial risk management. This paper seeks to evaluate performance in VaR measures in a class of smooth transition (ST) heteroskedastic models. Three distinct ST functions with generalized autoregressive conditional heteroskedasticity (GARCH) models are employed: the first-order, the second-order logistic functions, and the exponential function. We investigate the properties of the second-order logistic ST function which introduces two smooth transitions among three regimes defined by two thresholds. The Bayesian solution is adapted and designed for parameter estimations through Markov chain Monte Carlo scheme. We conduct an out-of-sample forecast of the proposed three variant ST-GARCH models with some existing, competing models, for four major stock market returns. The performance of a variety of risk models is examined by out-of-sample forecasts and the forecast accuracy for all models is diagnosed by four volatility proxies. Results reveal that the three ST-GARCH models were clearly favoured at the 1% level.

ID376 Carlos Trucios Maza (University of Campinas) - *Volatility and return bootstrap prediction intervals in GARCH models in the presence of outliers*, co-authors: Luiz Hotta, University of Campinas; Esther Ruiz, University Carlos III of Madrid
E-mail: ctrucios@gmail.com
Abstract: The GARCH models are widely used to modeling volatility, and an important part of modeling volatility is the construction of prediction intervals. Traditional methods of constructing prediction intervals for time series normally assume that the model parameters are known, and the innovations are normally distributed. When these assumptions are not true, the prediction interval obtained usually has the wrong coverage. These assumptions are not satis ed in nancial time series and we cannot use the usual approach. An alternative to this approach is to obtain prediction intervals using bootstrap procedures. Pascual, Romo and Ruiz [1] (PRR) propose a algorithm to obtain prediction intervals for returns and volatilities in GARCH models using bootstrap procedures and has shown good performance. Other interesting topic of research is the e ects of outliers in GARCH models, and studies on the e ect of outliers on estimation in GARCH models were analyzed, for instance, by [4], [2] and [3] among others. A lot of empirical works has been done to obtain prediction intervals using the PRR algorithm, although, the e ects of outliers in this algorithm has not been veri ed. We show that when the series are contaminated with outliers the PRR algorithm do not work very well. In this work we analyzed by mean of Monte Carlo experiments the e ect of outliers in the construction of prediction intervals for returns and volatilities and propose the use of methods robust to the presence of outliers, in particular it is used the methods used in [2] and [3].

ID12 Yuzhi Cai (Swansea University) - *Forecasting using Indirect-VaR TGARCH models*

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Abstract: VaR is defined as the value that a portfolio will lose with a given probability over a certain period of time. The Indirect-VaR TGARCH model is one of the models proposed recently for studying VaR. This talk presents a forecasting method for financial returns using the Indirec-VaR TGARCH model. This forecasting method is significantly different from the existing forecasting methods in the literature, because our method only depends on a single quantile model at a level of our choice. Furthermore, our forecasting method enables us to obtain the whole predictive density functions, hence any predictive quantities of interest can be obtained. We also applied the forecasting method to real financial returns and the results suggest that the forecasting method can be very useful in practice.

ID17 Massimiliano Caporin (University of Padova) - *Chasing volatility: a persistent multiplicative error model with jumps*, co-authors: Eduardo Rossi, University of Padova; Paolo Santucci de Magistris, University of Aarhus

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Abstract: The volatility of financial returns is characterized by persistence and occurrence of unpredictable large increments. We introduce a a Multiplicative Error Model with jumps (MEM-J) to model the realized measures measures of volatility. The model allows for both jumps and persistence in volatility. The conditional density of the realized measure is shown to be, when a jump component is included in the multiplicative specification, a finite mixture of Gamma and K distributions. The latter has never been used in the econometric literature. The conditional moments and the likelihood function are thus obtained in closed form. A Monte Carlo simulation experiment shows that maximum likelihood estimates of the jump component are reliable even when jumps are rare events. We estimate alternative specifications of the model using a set of daily bipower measures for 8 stock indexes. The estimates of the jump component for the stock indexes considered confirm that the probability of jumps is dramatically increased during the last financial crisis. A positive probability of jumps in volatility is estimated for all cases considered, which is consistent with the findings of previous studies on the topic. The results stress the importance of the inclusion of the jump component, with a time-varying intensity, in the volatility model for in-sample and out-of-sample tail forecasts.

FIN9   Financial markets

Date: Tuesday July 1, 3:00-4:00pm
Venue: Van Beuningen
Chair: Patrick Verwijmeren (Erasmus University Rotterdam)

ID352 Evangelos Vagenas-Nanos (University of Glasgow) - *Divergence of Sentiment*, co-authors: Antonios Siganos, University of Glasgow; Patrick Verwijmeren, Erasmus University Rotterdam
E-mail: evangelos.vagenas-nanos@glasgow.ac.uk
Abstract: We examine the effects of divergence of sentiment on trading volume and stock price volatility. Sentiment varies substantially among people on any given day, and we use status updates on Facebook across 20 countries to capture daily divergence in sentiment within a country. In-line with theoretical models predicting that differences of opinion cause trading, we find that divergence of sentiment positively affects trading volume and stock price volatility. Our results highlight an important effect of sentiment on financial markets that goes beyond an effect of the level of sentiment.

ID139 Johan Duyvesteyn (Robeco) - *Forecasting sovereign default risk with Mertons model*, co-author: Martin Martens, Erasmus University Rotterdam
E-mail: j.duyvesteyn@robeco.nl
Abstract: A recent study adapts Merton's structural model for corporations to make it applicable to sovereign countries that have issued both local and foreign currency debt. This paper tests the empirical implications of the model for thirteen emerging markets. We find a strong time-series correlation between model implied credit spreads and market CDS spreads. In addition we show that the most important determinant of the distance-to-default is the exchange rate volatility. Recent changes of exchange rate volatility predict sovereign CDS returns, both for relative cross-country differences and individual countries.

ID171 Agnieszka Markiewicz (Erasmus University Rotterdam) – *Model Uncertainty and Exchange Rate Forecasting*, co-authors: Roy Kouwenberg, Mahidol University; Ralph Verhoesky, DNB
E-mail: markiewicz@ese.eur.nl
Abstract: We propose a theoretical framework of exchange rate behavior where investors focus on a subset of economic fundamentals. We find that any adjustment in the set of predictors used by investors leads to changes in the relation between the exchange rate and fundamentals. We test the validity of this framework via a backward elimination rule which captures the current set of fundamentals that best predicts the exchange rate. Out-of-sample forecasting tests show that the backward elimination rule significantly beats the random walk for four out of five currencies in our sample. Further, the currency forecasts generate economically meaningful investment profits.

FIN10   Volatility and big data
Date: Tuesday July 1, 3:00-4:00pm
Venue: Ruys
Chair: Elena Dumitrescu (Paris West University Nanterre la Défense)

ID46   Moritz Heiden (University of Augsburg) - *Forecasting Volatility with Empirical Similarity and Google Trends*, Co-Author: Alain Hamid, University of Augsburg
E-mail: moritz.heiden@wiwi.uni-augsburg.de
Abstract: This paper proposes an empirical similarity approach to forecast weekly volatility by using search engine data as a measure of investors attention to the stock market index. Our model is assumption free with respect to the underlying process of investors attention and significantly outperforms conventional time-series models in an out-of-sample forecasting framework. We find that especially in high-volatility market phases prediction accuracy increases together with investor attention. The practical implications for risk management are highlighted in a Value-at-Risk forecasting exercise, where our model produces more accurate forecasts while requiring less capital due to fewer overpredictions.

ID237 Myrthe van Dieijen (Erasmus University Rotterdam) - *Volatility spillovers across stock returns and user-generated content*, co-authors: Abhishek Borah, Michael G. Foster School of Business; Philip Hans Franses, Erasmus School of Economics; Gerard Tellis, USC Marshall School of Business
E-mail: myrthevandieijen@gmail.com
Abstract: This study assesses the interdependence across stock returns and user-generated content (UGC) by investigating the presence of volatility spillover and volatility persistence effects. Positive and negative tweets, blog posts, forum posts and Google search tickers are used as measures of UGC. The UGC data is collected via multiple sources over a six month period. Using a multivariate generalised autoregressive conditional heteroscedasticity - Baba, Engle, Kraft and Kroner (GARCH-BEKK) model we identify the source and magnitude of the volatility spillover and volatility persistence effects between UGC and returns. The results confirm the presence of these effects and show that the spillover and persistence effects from UGC on returns are greater than from returns to UGC. The (positive) volatility spillover and persistence effects from forum posts to returns are the largest. There are volatility spillover and persistence effects present between the various UGC variables as well and these are larger than the effects from returns to UGC.

ID81 Elena Dumitrescu (Paris West University Nanterre la Défense) – *Exchange Rate Volatility Forecasting: a Multivariate Realized-GARCH Approach*, co-authors: Janine Balter; Peter Hansen, European University Institute
E-mail: elena-ivona.dumitrescu@eui.eu
Abstract: This paper proposes a new simple and parsimonious way to jointly model and forecast the returns, realized and conditional measures of volatility and correlation of different foreign exchange markets. Our multivariate realized GARCH model combines the simplitude and flexibility of the GARCH approach and the advantages of high-frequency (intraday) data in terms of statistical precision in the estimation of volatility. We hence introduce a multivariate specification that jointly models the dynamics of the conditional and realized measures of covariance while accounting for spillover effects. It

incorporates the information available in the tick-by- tick exchange rate prices by elaborating on the Realized EGARCH specification proposed by Hansen and Huang (2012). It makes it possible to investigate the dynamics of exchange rates volatility and the propagation of shocks in foreign exchange markets during both crisis and calm periods. Most importantly, the multivariate realized GARCH model allows not only to analyze the volatility spillovers between the exchange markets but also to forecast the volatility and correlations one-step and multi-step ahead. The empirical analysis looks at the EUR/USD and USD/JPY exchange rates during the low volatility and high volatility periods from January 2005 to December 2012. We find that the spillovers between the two exchange rates are large and their direction depends on the state of the financial markets. The Model Confidence Set test by Hansen et al. (2011) and the Diebold-Mariano-West test based on a 'robust' loss function à la Patton (2011) show that our model provides more accurate forecasts than the main competitors especially when volatility and correlation fluctuate heavily, i.e. during the recent financial crisis. The superior out-of-sample performance of our method with respect to that of existing models especially during high volatility periods indicates that it is a useful tool for forecasting risk in forex markets.

FIN11   Term structures
Date: Wednesday July 2, 10:00-11:00am
Venue: Van Beuningen
Chair: Dedi Rosadi (Gadjah Mada University)

ID234   Lorenzo Boldrini (CREATES, Aarhus University) - *Supervision in dynamic factor models*, Co-author: Eric Tobias Hillebrand, CREATES, Aarhus University
E-mail: lboldrini@creates.au.dk
Abstract: We study the forecast power of yield curve data for macroeconomic time series, such as consumer price index, personal consumption expenditures, producer price index, real disposable income, unemployment rate, federal funds rate and industrial production. We employ a state space model in which the forecasting objective is included in the state vector. This amounts to an augmented dynamic factor model in which the factors (level, slope and curvature of the yield curve) are supervised for the macroeconomic forecast target. In other words, the factors are informed about the dynamics of the forecast target. The factor loadings have the Nelson and Siegel (1987) structure, and we consider one forecast target at a time. We compare the forecasting performance to benchmark models such as principal components regression, partial least squares, and ARMA(p,q) processes. We use the yield curve data of Gürkaynak, Sack, and Wright (2006) and macroeconomic data from FRED, covering the sample period 1st January 1961 to 1st January 2012. We compare the models by means of the conditional predictive ability test of Giacomini and White (2006) and the model confidence set of Hansen, Lunde and Nason (2011). We find that the yield curve does have forecast power for the macroeconomic time series and that supervising the factor extraction for the forecast target can improve forecast performance. We also compare direct and indirect forecasts for the different models and find that the indirect forecasts perform better for our data and specification.

ID273   Wali Ullah (Tohoku University) - *Generalized Nelson-Siegel Term Structure Model*, Co-author: Yasumasa Matsuda, Tohoku University
E-mail: wali76@yahoo.com
Abstract: The term structure of interest rates is a static function that relates the time-to-maturity to the zero rates at a given point in time. The conventional way of measuring the term structure is by means of the spot rate curve, or yield curve, on zero-coupon bonds. However, the entire term structure is not directly observable, which gives rise to the need to estimate it using some approximation technique. There are a wide variety of diverse yield models, with objective to accurately model and describe the future yield curve structure as much possible. In recent years, the Nelson-Siegel (1987) model and its extended versions have been credited for its high efficacy in the in-sample fitting and out-of-sample forecasting of the term structures of interest rates. However, when we estimate the Japanese government bonds (JGBs) yield curve, selecting a method without careful consideration might result in the estimation of a curve that does not grasp the characteristics of the JGBs yield curve. For JGBs since 1999, yield curves under the zero interest rate policy and the quantitative easing monetary policy have distinctive features. During this periods, the yield curve has a flat shape near zero at the short-term maturities. The second feature frequently seen in the JGBs interest rate term structure is that it has a complex shape with multiple inflection points. Moreover, at some dates the curve is initially falling and then gradually rising. Some models and

estimation methods may not grasp this kind of curve features and shape. The regular Nelson-Siegel functional form, both the dynamic Nelson-Siegel (DNS) as well as affine Nelson-Siegel (AFNS), cannot fit attractively the short maturities if the estimate of decay parameter λ is constrained to be smaller than 0.025 (which fits well long maturities). On the other hand, leaving the λ to be unconstrained implies to fit short maturities very well. In empirical estimation this limitation shows up as a lack of fit either at the short end of curve or of the long-term yields. This implies that the regular Nelson-Siegel model in both forms, i.e., affine and non-affine versions, cannot replicates the stylized facts and features of the Japanese bond market yield curve. In order to avoid such difficulties and select a better candidate model to accurately grasp the characteristics of the JGBs yield curve, in this paper, a closely related generalized Nelson-Siegel model (GDNS) with two slopes and curvatures is considered and compared empirically to the traditional DNS in terms of in-sample fit as well as out-of-sample forecasts. Furthermore, the GDNS with time-varying volatility component, modelled as standard EGARCH process, is also considered to evaluate its performance in relation to the GDNS. The GDNS models unanimously outperforms the DNS in terms of in-sample fit as well as out-of-sample forecasts. Moreover, the extended model that accounts for time-varying volatility outpace the other models for fitting the yield curve and produce relatively more accurate 6- and 12-month ahead forecasts, while the GDNS model comes with more precise forecasts for very short forecast horizons.

ID312 Dedi Rosadi (Gadjah Mada University) - *Modeling and forecasting the term structure of government bond yields*
E-mail: dedirosadi@gadjahmada.edu
Abstract: In this paper, we discuss the problem of of modeling and forecasting the yield curve of government bond. We first model the yield curve using using Nelson-Siegel (NS) model classes. In particular we introduced what so called the 6-factors NS model and further estimate the parameters using the hybrid-Genetic Algorithm approach. In Muslim, Rosadi, Gunardi and Abdurakhman (2014) we show this particular model and estimation method is found to have the best performance for estimating the yield curve. Then, we forecast various parameters of the 6-factors NS yield curve using neural networks and Vector Autoregression (VAR) (Rosadi, Nugraha, Dewi, 2011). The forecasted 6-factors NS parameters are then used to calculate the yield curve of the government bonds. The empirical studies are provided using Indonesian Government Bond data, obtained from Indonesia financial market. All the computation are done using open source software R, where in particular we also use R-GUI package RcmdrPlugin.Econometrics (Rosadi, 2010).

FIN12   Sovereign credit
Date: Wednesday July 2, 10:00-11:00am
Venue: Van Rijckevorsel
Chair: Marinda Pretorius (University of Johannesburg)

ID123 Jiri Svec (University of Sydney) - *Forecasting sovereign credit spreads using domestic equity market volatility*, co-authors: Jue Wang, The University of Sydney; Maurice Peat, The University of Sydney
E-mail: jiri.svec@sydney.edu.au
Abstract: This paper investigates the forecasting performance of domestic equity market volatility in predicting sovereign credit default swap (CDS) spreads. We focus on historical and option-implied volatility as well as fundamental volatility extracted from forecast combinations via a Kalman filter. Through a regression analysis and a structural sovereign model, we demonstrate the prediction superiority of fundamental volatility over existing measures. Our pricing error statistics are comparable to those reported in the corporate literature, supporting the use of a structural model as a tool for forecasting sovereign credit risk.

ID228 Marinda Pretorius (University of Johannesburg) - *A panel ordered response model for sovereign credit ratings in Africa*, co-author: Ilse Botha, University of Johannesburg
E-mail: marindap@uj.ac.za
Abstract: Sovereign credit ratings measure a country's ability to meet its financial obligations. These credit ratings are an indication of the economic, financial and political situation of an economy and signals important information regarding a country's development to governments and international financial markets (Afonso, 2003). It is therefore imperative to consider the specific determinants of these ratings as it influence the decisions of investors and other role players. The role of the African continent in global financial markets is receiving progressively more attention. This study identifies the determinants of sovereign credit ratings for 28 African countries by making use of a panel ordered response model. The study also provides a forecast of the ratings based on the model. The results confirm the importance of the determinants of credit ratings identified by the seminal work of Cantor and Packer (1996). Some differences occur between findings from literature, which mainly focus on developed and developing countries, and the findings of this paper which solely focus on African countries.

FIN13   Early warning signals
Date: Wednesday July 2, 11:25am-12:45pm
Venue: Van Beuningen
Chair: Gian Luigi Mazzi (Eurostat)

ID201   Daniel Felix Ahelegbey (Ca'Foscari University Venice) - *Sparse High Dimensional Multivariate Autoregressive Models*, Co-authors: Roberto Casarin, Ca' Foscari University Venice; Monica Billio, Ca' Foscari University Venice
E-mail: dfkahey@unive.it
Abstract: We develop a Bayesian graphical inference approach to address inferential difficulties and variable selection problems encountered in sparse high-dimension multivariate autoregressive models and in large dataset handling. The contribution of the paper is to propose a new and efficient multi-move Markov chain Monte Carlo (MCMC) algorithm for approximate inference on the causal structure and the lag length of the process. This new algorithm proves to be effective for the inference of high-dimensional Gaussian graphical models and variable selection in sparse multivariate dynamic models. One of the applied contributions is an empirical assessment of the linkages between financial and non-financial super-sectors in the Eurozone to assess the interconnectedness of the system and thus its vulnerability. Our result shows that not only are financial institutions highly interconnected before and during crisis periods, but also, financial and non-financial institutions are highly interconnected during such periods.

ID328 Tuomas Peltonen (European Central Bank) - *Measures of Tail Dependence to Predict Distress in European Banks*, co-authors: Frank Betz, European Investment Bank; Peter Sarlin, Abo Akademi
E-mail: tuomas.peltonen@ecb.europa.eu
Abstract: The paper develops an Early Warning System (EWS) for predicting distress in European banks. The EWS attempts to predict vulnerabilities leading to distress events using both bank and country-level data. A novel model extension introduces an estimated tail dependence network of banks in order to take into account vulnerabilities arising from contagion. The main finding of the paper is that the early warning model containing information on the potential vulnerabilities of the interconnected banks leads to superior predictions of bank failures. Thus, this emphasizes the importance of taking network effects (i.e. cross-sectional dimension of systemic risk) into account when building a bank EWS.

ID244 Katja Taipalus (Bank of Finland) - *Detecting asset price bubbles with time-series methods*
E-mail: katja.taipalus@bof.fi
Abstract: To promote financial stability, there is a need for an early warning system to signal the formation of asset price misalignments. This research provides two novel methods to accomplish this task. Results in this research shows that the conventional unit root tests in modified forms can be used to construct early warning indicators for bubbles in financial markets. These new indicators are tested via MC simulations to analyze their ability to signal emerging unit roots in time series. According to the results they seem to be more robust and to have more power in the presence of changing persistence than the standard stability and unit root tests. When these new tests are applied to real US stock market data starting from 1871, they are able to signal most of the consensus bubbles. The results are encouraging when these methods are applied to wider set of data. In most of the cases the indicators

seem to work relatively well, indicating bubbles in equities and housing prices well before the periods which, according to the consensus literature, are seen as periods of sizeable upward or downward movements.

ID329 Peter Sarlin (Goethe University Frankfurt) - *Deriving and evaluating policy-relevant bank distress models*, co-authors: Jan-Hannes, European Central Bank; Tuomas Peltonen, European Central Bank
E-mail: psarlin@abo.fi
Abstract: This paper provides a systematic approach to deriving policy-relevant bank distress models, with an eye to robust, parsimonious and stable specifications. We define an objective function for policy-relevance, and provide a structured and a regularized approach to defining distress model specifications. The framework is tested on a pan-European dataset of banks, in order to investigate overall risk drivers, as well as differences over forecast horizons, policymakers' preferences between type I/II errors and distress event definitions.

FIN14   Stock markets and investments
Date: Wednesday July 2, 11:25am-12:45pm
Venue: Schadee
Chair: John Guerard (McKinley Capital Management)

ID334   Maruf Raheem (Sheffield Hallam University) - *A Three-State Markov Approach to Predicting Asset Returns*, Co-author: Patrick Ezepue, Sheffield Hallam University
E-mail: Maruf.A.Raheem@student.shu.ac.uk
Abstract: We present in this work, alternative approach to determining and predicting the fluctuations in the stock returns of a company at the stock market. A three- state Markov is proposed to estimate the expected length of an asset return to remain in a state, which may be, rising(positive) state(RK), falling(negative) state(Rm) or stable(zero) state (RL). Daily closing prices of stocks of a major and first generation bank in Nigeria are studied. The results show that for the 5 years, encompassing the period of post banking reform of 2004 and period of global financial crisis of 2008, no significant asymmetric and leverage effect on the returns of this bank. Rather, the bank's asset prices remain stable; thereby given rise to making little or no gain, and at the same time the loss was kept at bay. It is optimistic that adopting this method, investors are better guided in their choice of future investment

ID165   Jonathan Reeves (University of New South Wales) - *Monthly Beta Forecasting with Low, Medium and High Frequency Stock Returns*, Co-authors: Tolga Cenesizoglu, HEC Montreal; Qianqiu Liu, University of Hawaii
E-mail: reeves@unsw.edu.au
Abstract: Generating one-month-ahead systematic (beta) risk forecasts is common place in financial management. This paper evaluates the accuracy of these beta forecasts in three return measurement settings; monthly, daily and 30 minutes. It is found that the popular Fama-MacBeth beta from 5 years of monthly returns generates the most accurate beta forecast among estimators based on monthly returns. A realized beta estimator from daily returns over the prior year, generates the most accurate beta forecast among estimators based on daily returns. A realized beta estimator from 30 minute returns over the prior 2 months, generates the most accurate beta forecast among estimators based on 30 minute returns. In environments where low, medium and high frequency returns are accurately available, beta forecasting with low frequency returns are the least accurate and beta forecasting with high frequency returns are the most accurate. The improvements in precision of the beta forecasts are demonstrated in portfolio optimization for a targeted beta exposure.

ID249 Peter Fraser-Mackenzie (University of Southampton) - Forecasting retail spread-trader survival and the impact on the market population structure during the recent financial crisis, co-authors: Tiejen Ma, University of Southampton; Ming-Chien Sung, University of Southampton; Johnnie Johnson, University of Southampton
E-mail: p.fraser-mackenzie@soton.ac.uk
Abstract: The retail spread trading market is a rapidly growing sector of the financial market with about half a million financial spread traders operating in the UK and this number is expected to reach one million by 2017 (Pryor, 2011). Brady and Ramyar (2006) indicate that, of the £1.2 trillion traded annually on the London Stock Exchange,

40 per cent is equity-derivative related and 25 per cent of this relates to spread trading (£120 billion). However, our analysis shows that most of these traders are unprofitable and frequently display behavioral biases such as the disposition effect – behavior typical of that exhibited by "noise traders". According to the Market Selection Hypothesis (MSH) and simulation studies, noise traders should find it difficult to survive (i.e. continue trading) for any long period of time as they ought to be forced out via a form of evolutionary process. In this study we test whether these evolutionary forces do indeed forecast retail spread-trader's trading lifespan during the recent financial crisis of 2008/09 using survival analysis and the implications this has for the population structure and market efficiency. Our results showed that spread traders in bearish conditions (e.g., during the recent downturn) were forecast to stop trading sooner than in bullish market conditions, suggesting that the crisis may have forced these traders from the market. We also reveal that those spread-traders whose trading behavior is most characteristic of noise traders (i.e., unprofitable or displaying poor trading discipline) were forecast to cease trading sooner than other spread traders. This finding is consistent with the MSH, which suggests that market evolution will force noise traders from the market, moving it towards long-run efficiency. However, contrary to the MSH, we also found that profitable traders were more likely to cease trading sooner than the average trader. Furthermore, following September 2008 there appeared to be an increase in the numbers of noise traders entering the market. The net result was an increase in the proportion of noise traders in the spread-trading population following the financial crisis - the opposite to what would be expected based on the MSH. Our observation that there was an increase in the indiscipline of new generations of traders entering the market following the crisis could partially explain the failure of the forces underpinning the MSH to improve efficiency in the market. We discuss the implications of all these findings for the MSH and come to the conclusion that the recent financial crisis may have had limited positive impact on the evolution towards long-run market rationality.

ID374 John Guerard (McKinley Capital Management) - *Investing in Global and Emerging Markets: An Application of Integer Programming*, co-authors: Harry Markowitz, McKinley Capital Management; Ganlin Xu, McKinley Capital Management; Sundaram Chettiappan, McKinley Capital Management

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Abstract: In this analysis of the risk and return of stocks in global markets, we apply several portfolio construction and optimization techniques to U.S. and global stock universes. We find that (1) mean-variance techniques continue to produce portfolios capable of generating excess returns above transactions costs and statistically significant asset selection, (2) optimization techniques minimizing tracking error at risk are statistically significant in portfolio construction; and (3) emerging markets offer the potential for high returns relative to risk. In this experiment, mean-variance tracking error at risk and enhanced index-tracking techniques are examined. Integer programming is necessary if an investor prefers concentrated portfolios. We estimate expected return models in global and emerging equity markets using a given stock selection model and generate statistically significant active returns from various portfolio construction techniques.

APP1   Prediction markets
Date: Monday June 30, 10:00-11:00am
Venue: Van Rijckevorsel
Chair: Rubell Marion Lincy George (National Institute of Technology Calicut, Kerala)

ID65   Qin Xiao (University of Hull) - *Does the listed real estate sector exhibit similar price cycles to direct investments in real estate?*, Co-author: Steven Devaney, University of Reading
E-mail: q.xiao@hull.ac.uk
Abstract: This study investigates the extent to which returns from the listed real estate sector are related to returns in the direct real estate market for the US and UK. Past research has often used valuation based indices for the direct real estate market, but these are criticised with regard to their perceived smoothing and lagging of market performance. In contrast, this study uses transaction based/linked indices of direct real estate prices, as well as valuation based ones for the purpose of comparison. Returns, standard deviations, correlations and peaks and troughs are compared before the techniques of spectral and cross-spectral analysis are used for examining the cyclical attributes of the data. We find that movements in listed sector returns lead those in the direct market regardless of whether a transaction or valuation based series is used for the latter. Spectral analysis suggests cycles of 5.5 years for several listed sector series, but similar cycles are not found for the direct market. Nonetheless, cross-spectral analysis shows that the degree of coherency between direct and listed real estate rises when longer term movements in the series are analysed.

ID265 David McDonald (University of Southampton) - *Forecasting competitive events with the Kalman filter*, Co-author: Tiejun Ma, University of Southampton; Ming-Chien Sung, University of Southampton; Johnnie Johnson, University of Southampton
E-mail: d.mcdonald@soton.ac.uk
Abstract: One of the main challenges associated with forecasting outcomes of competitive events, such as sporting events, horseraces, and political elections, is to account for both the intensity of competition among alternatives and incorporate information derived from market prices in the associated betting markets to improve forecasting accuracy. To address this, we develop a novel two-stage modelling approach. In stage one, we adopt the Kalman filter, an effective time-series forecasting approach in financial markets, to track and forecast changes in market prices, which reflect the public opinion of the chances of each individual competitor. In stage two, these forecasts are combined with competitor attributes to arrive at a probabilistic prediction of event outcomes. Our empirical test employs a dataset consisting of time series of market prices at 1 minute intervals in 2,500 individual markets from the 2013 UK flat racing season, comprising over 1 million data points overall. The Kalman filter outperforms other trend analysis methods in a range of measures of forecasting accuracy. Furthermore, a Kelly betting strategy based on the predictions of the second-stage model is constructed and shows significant positive returns. Since our combined forecasting approach extracts additional information from changing public views that is not fully discounted in market prices, our study provides new evidence that betting markets are informationally inefficient.

ID293   Rubell Marion Lincy George (National Institute of Technology Calicut, Kerala) - *Daily Stock Trend Forecasting using Fuzzy Rule-based Reinforcement Learning Agent and Portfolio Management*, Co-author: Jesse John, National Institute of Technology Calicut
E-mail: lincypsgtech@gmail.com

Abstract: The aim of this paper is to develop a fuzzy rule-based reinforcement learning agent with modules of structure and parameter learning included. The daily stock trading scenario is first modeled as a Markov Decision Process (MDP) and then solved using Reinforcement Learning (RL). The fuzzy rule-based system is incorporated into the system to attain better function approximation. The proposed model thus takes the time series of daily stock price for processing and provides suggestions to buy/sell/hold (stay out of the market) for a particular stock. The performance of the proposed model is evaluated using the daily stock index price data set of State Bank of India (SBI). The model is then applied to develop a portfolio by considering the stocks from the Bombay Stock Exchange and also to obtain the performance of the portfolio management for over a period of time. Our experimental results obtained by simulating the model using MATLAB demonstrate the effectiveness and robustness of the proposed model in comparison with the existing models.

APP2   Marketing

Date: Monday June 30, 11:25am-12:45pm
Venue: Hudig
Chair: Hyung Soo Lim (KAIST College of Business)

ID104 Scott Armstrong (Wharton School, University of Pennsylvania) - Predictive Validity of Evidence-Based Persuasion Principles: An Application of the Index Method, co-authors: Du Rui, University of Pennsylvania; Kesten Green, University of South Australia
E-mail: armstrong@wharton.upenn.edu

Abstract: This study develops an index model for predicting the effectiveness of advertisements based on 195 evidence-based persuasion principles that were derived from a prior review of empirical, mostly experimental, research. The index model sums the points credited by a rater who assesses the application of each of the principles to an advertisement. The higher the index score, the better the application of the principles. The predictive validity of this persuasion principles index was tested against recall data for 96 pairs of print advertisements using the ratings of self-trained novices. The index scores calculated from their ratings correctly predicted which ad was the better recalled for 75% of the pairs. Predictions by experts using their unaided judgment were correct for 55%. The persuasion principles index method was thus responsible for reducing error by 43% compared to the method usually employed. The finding is consistent with previous research on the value of evidence-based procedures and on the validity of the index method for modeling cumulative knowledge about situations involving many important variables.

ID189 Harald Hruschka (University of Regensburg) - Multicategory Purchase Incidence Models for Partitions of Product Categories
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Abstract: We analyze multicategory purchases of households by means of heterogeneous multivariate probit models which relate to partitions of a total of 25 product categories. We investigate both prior and post hoc partitions and also consider two variants of heterogeneous multivariate probit models one of which includes cross effects of marketing variables as well. We search model structures by a stochastic algorithm and estimate models by Markov chain Monte Carlo simulation to construct household clusters and to sample stochastic utilities, a correlation matrix, category constants and coefficients for each group and cluster. We evaluate performance of models by cross-validated log likelihood values. The best model refers to a post hoc partition with two groups, the second best model considers all categories as one group. Among prior partitions with at least two groups a model for five groups leads to the highest cross-validated log likelihood. We infer managerial implications with respect to product categories selected for two marketing variables, features and display. Simply selecting the categories with the highest average effects of these marketing variables turns out to be suboptimal. With respect to the categories selected it does not matter on which of these three alternative models optimization is based, but the model with five prior category groups heavily underpredicts sales.

ID298 Tina Javornik (Leder & Schuh AG) - A model for predicting store performance of new retail locations, co-authors: Markus Kohlbacher, Leder & Schuh AG; Peter Horvath, Leder & Schuh AG; Christina Anna Neuwirth, Leder & Schuh AG;

E-mail: Tina.Javornik@lsag.com

Abstract: Expansion in retail is often connected to hazardous decision-making. Because convenience is so important to today's consumers, a retail store can prosper or fail solely on its location. Although formal techniques of new store location decisions have been available for many years, most retailers traditionally made no use of them, relying instead on intuition guided by experience and common sense. By using data from a European fashion retailer, we empirically analyze the impact of different store location aspects on sales. Based on the analysis, we build a model with which the future sales of a new store located in shopping centers can be predicted. The purposed model integrates different characteristics of the shopping center, whereby the influence of competitor intensity, the attractiveness of the shopping center and the characteristics of the store itself on sales are tested by using multivariate analysis methods. To capture the full picture of the attractiveness of the mall, data regarding the shopping center's accessibility, as well as the variety and quantity of the shopping center's stores have been collected. The analyzed shop characteristics contain the size of the store and the location within the shopping center, including the analysis of the neighboring shops. Our findings reveal that agglomeration economies are of significant importance in explaining store performance. The results indicate that not the number of competitors by itself, but rather the variety of the shopping center's stores have an enormous influence on the store performance. What is more, the relationship between the quantity of specific anchor shops and the total number of stores in the shopping center increase the turnover as well. One of the findings also indicates the significant negative effect on shop performance, caused by the store's size in a ratio to a specific group of anchor shops. With the help of this model, sales of a new store location can be predicted with an average estimated-error of 12%. Our further research will include environmental aspects of the shopping center. The adaptation of the model will therefore include new characteristics such as commuting area, purchasing power, or the competitive environment of the shopping center.

ID299 Hyung Soo Lim (KAIST College of Business) - *An Economic Conjoint Model for Optimal Pricing under Lexicographic Preferences*, co-authors: Duk Bin Jun, KAIST College of Business; Hyung Soo, KAIST College of Business; Dong Soo Kim, KAIST College of Business

E-mail: semo0519@business.kaist.ac.kr

Abstract: Consumer's preference structure is varying over product categories. As for some durable goods, such as laptops and smartphones, consumers tend to distinguish a product from its competing products by differences in several features ordered in their importance. This preference structure, so called lexicographic preference, does not allow us to simply find the optimal marketing mix strategy, especially pricing, in two ways: First, there is no simple utility function that captures the cardinal link with a continuous price variable as well as the ordinal preference structure. Second, the latent process of ordering attributes according to their importance cannot be easily calibrated in the conventional manners, such as MLE, GMM, and Bayesian methods. In this paper, we propose an economic framework that takes into account the ordinal lexicographic preference, the cardinal link with prices, and the latent ordering process by introducing a nested utility specification and a data augmentation technique that employs multinomial-Dirichlet conjugacy. Based on the proposed framework, we show how to figure out an optimal pricing strategy and provide the impact of lexicographic preferences on the optimal strategy.

APP3   Tourism I
Date: Monday June 30, 11:25am-12:45pm
Venue: Schadee
Chair: Nurbanu Bursa (Hacettepe University)

ID24 Ulrich Gunter (MODUL University Vienna) - *Forecasting Tourism Demand with Google Trends: The Case of Vienna*, co-author: Irem Onder, MODUL University of Vienna
E-mail: ulrich.gunter@modul.ac.at
Abstract: The purpose of this study is to investigate whether Google Trends data for web and image search have predictive power in terms of improving forecasting accuracy of tourism demand relative to a baseline model. Vienna is chosen as a case example and four simplified autoregressive distributed lag models (ADLM) that allow for seasonality are derived to test this hypothesis: (1) baseline autoregressive model with own lags of tourism demand only, (2) web search index model, (3) image search index model, and (4) web and image search index model with Google Trends web and/or image search indices as additional explanatory variables, which are available for Vienna from 2008M1 onward. The estimation results confirm that Google Trends data have a statistically significant impact on the aggregate of domestic and international tourist arrivals to Vienna. The ex-post forecasting accuracy based on expanding estimation windows is assessed in terms of MAPE and RMPSE for horizons 1, 2, 3, 6, and 12 months ahead. The accuracy is improved for horizons 1, 2, 3, and 6 when Google Trends data are included, thereby underlining the usefulness of Google Trends data as predictor for short-term forecasting. In addition, naive-1 and seasonal naive benchmarks are significantly outperformed across horizons according to the Hansen test on superior predictive ability.

ID211 Chenguang Wu (Sun Yat-sen University) - *Nonlinear impact of exchange rates on Chinese outbound tourism demand - An error correction panel smooth transition regression model*, co-authors: Huilin Song, China Tourism Academy; Gang Li, University of Surrey; Haiyan Song, The Hong Kong Polytechnic University
E-mail: wuchenguang@gmail.com
Abstract: Exchange rates have been examined and proved as an important variable to influence tourism demand directly, or indirectly through tourism prices, by a large body of empirical studies. Most of these studies examined the relationship between tourism demand and exchange rates under a linear relationship assumption, which means that the impact of exchange rates on tourism demand remains constant over time. In reality however, the relationship between tourism demand and its determinants is nonlinear in nature. For example, when the exchange rates stay in a high level then a tourist may be more sensitive to the variation of exchange rates, whereas when the exchange rates have been continuously decreasing to a lower level then the tourist may be less sensitive to the variation of the exchange rates. In such cases nonlinear regression models may be more appropriate than their linear counterparts. This study therefore aims to first introduce a nonlinear regression modeling technique, i.e., an error correction form of panel smooth transition regression (EC-PSTR) model to examine the nonlinear characteristics of the demand for tourism. The outbound tourist flows to the top ten destinations from China are examined using the EC-PSTR model. Empirically, monthly data covering the period of 2008M9 to 2013M12 are employed for this study. Explanatory variables include exchange rates, tourism prices and tourist income. The empirical results provide new insights into the nonlinear characteristics of Chinese

outbound tourist behaviors. Based on the estimated EC-PSTAR model, both ex post and ex ante forecasting of the outbound tourism demand of Chinese tourists are performed. For ex post forecasting, selected linear models are used as benchmarks for accuracy comparison. For ex ante forecasting, Chinese outbound tourism demand is forecast for the future two years.

ID288 Shuang Cang (Bournemouth University) - *A Recommendation System for Tourist Visit Planning*, co-authors: Pree Thiengburanathum, Bournemouth University; Hongnian Yu, , Bournemouth University
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Abstract: Nowadays, vast information generated from the Internet and other sources, such as communication devices, sensors, guide books and maps makes tourists difficult to retrieve relevant information. It is a challenging task for tourists to make decisions in terms of their preferences in selection of destinations. To address the issues, a novel framework of attractions recommendation system for tourist is proposed. By combining with the personal factors such as demographic information, characteristics, motivations and travel types etc. in addition to the satisfaction ranking of the attractions together with the latest concept of Information Communications Technology (ICT), the framework of attractions recommendation system for tourist is proposed. The advanced decision tree and neural networks approaches are employed to predict the top attractions of the city/country. The satisfaction ranking according to these recommended attractions are listed as references to tourists. The proposed system promises to help tourists and travel agencies when facing an overwhelm information and to assist them in the decision-making process. The Google Map API is also used in the system framework for retrieving the GPS data of the point of interests, and to plot a connected route between them. The recommended routes and tourist attractions are illustrated through the user interface and Google Map. A test data set is selected for validation, and the study demonstrates that the neural networks approaches can be used to develop a route recommendation system for tourist planning. The extension of this research would generate the holistic trip plan based on the hard and soft constraints of the user, the databases (hotels, restaurants, and their geographic locations).

ID342 Nurbanu Bursa (Hacettepe University) - *The Relationship Between Tourism Expansion and Economic Development: The Case of Turkey*
E-mail: nurbanubursa@gmail.com
Abstract: In this study the causal relationship between tourism expansion and economic devolepment is investigated in Turkey by using quarterly data over the 1987-2013 period and annual data over the 1963-2013 period. A Granger causality test is performed following the cointegration approach to reveal the direction of causality between economic growth and tourism expansion. Test results indicate a long-run equilibrium relationship and further a bi-directional causality between two factors in annual series. However, in quarter series there is not causality relation between tourism expansion and economic growth.

APP4   Technology
Date: Monday June 30, 11:25am-12:45pm
Venue: Van der Vorm
Chair: Jonathan Davenport (Milner Strategic Marketing Ltd)

ID90 Deepak Singh (Jawaharlal Nehru University) - *India's Electrical Power Technology: Exploring Futures through the Delphi*, Co-author: Pranav N Desai, Jawaharlal Nehru University
E-mail: deepaksinghconvent@gmail.com
Abstract: This paper tries to explore various pathways for the futures of heavy electrical technology in India. It explores various dimensions of the Indian power sector and its plausible scenarios by looking into the part and the present interfaces of generations, transmission, distribution and consumption. The study uses the Delphi methodology in order to explore various scenarios in decadal time space ahead. The Delphi exercise was solely conducted online in two rounds with experts from various sections of society. The emphasis of study was multidisciplinary in nature to nullify or minimize any possible ambiguities in scenario planning. A priority matrix with number of short and long term priorities is been presented in the concluding part of the study as its recommendation.

ID159 Miriam Scaglione (University of Applied Sciences and Arts Western Switzerland Valais) - *A multigeneration forecasting on online hotel distribution channels*, co-author: Roland Schegg, University of Applied Sciences and Arts Western Switzerland Valais
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Abstract: The evolution of distribution channels in the hospitality sector has followed different paths over time depending on the technology used. This research analyses the evolution of market shares of different clusters or generations of distribution channels using multi-generation diffusion methods. The data for the study are a series of annual member surveys by hotelleriesuisse since 2002 which monitored the evolution of market shares of 15 individual distribution channels. We grouped the distribution channels into three generations starting with the pre-World-Wide-Web era (travel agent, destination organisation, etc.); the middle generation comprises Internet-based direct booking channels (e-mail, reservation forms on hotel websites, etc.) and the latest generation includes online intermediaries such as Online Travel Agencies and social media. The results of our analysis show substitution effects across different clusters of distribution channels and shed light on the dynamics of competing sales funnels. From the practitioner's point of view, the study gives insight into the future evolution of the distribution mix. This evolution is crucial for hotel marketing strategies as the Internet is the most powerful marketing tool in the hospitality industry today.

ID283 Christos J. Emmanouilides (Aristotle University of Thessaloniki) – *Data smoothing models for early innovation diffusion forecasting*
E-mail: cemman@econ.auth.gr
Abstract: The aim of this paper is to assess the usefulness of data smoothing models in forecasting new product diffusion processes at their early stages. A large scale forecast comparison exercise is set up using more than one thousand real diffusion data series. The forecasting performance of established diffusion models is compared with the performance of non-parametric regression and exponential smoothing models. The study offers evidence that, despite their theoretical and empirical shortcomings (e.g. lack of diffusion-theoretical justification, absence of saturation level for the market potential,

etc.), smoothing models tend to provide more accurate early diffusion forecasts than routinely used innovation diffusion models.

ID366 Jonathan Davenport (Milner Strategic Marketing Ltd) - *Forecasting the future of markets for profit*, Co-authors: Nick Milner, Milner Strategic Marketing Ltd; Kay Sharpington, Milner Strategic Marketing Ltd
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Abstract: Markets are complex and multidimensional. A market model allows businesses to understand this complexity and is the only way to fully map the interactions between the core structural elements in the market. By selecting appropriately from the tools and techniques it is possible to forecast market behaviour with a high degree of accuracy using a market model. This accurate understanding of future consumer adoption rates and competitor performance plays an essential role in strategic planning. By combining all available insights to create one picture of market behaviour the business can invest in the right markets and target the right segments. As a result of this the company can benefit from increased sales volumes, reduced costs, time efficiencies and better company-wide strategic alignment.

APP5   Telecommunications & ICT
Date: Monday June 30, 3:00-4:00pm
Venue: Hudig
Chair: Mohsen Hamoudia (Orange - France Telecom Group)

ID205 Emanuele Giovannetti (Anglia Ruskin University- IIMP) - Predicting the Introduction of New Technologies in the UK: the role of ICT investment and Innovation Spillovers, co-author: Claudio Piga, Keele University
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Abstract: In this paper, we focus on the analysis of innovation knowledge spillovers and on their impact on the innovation activities, in general and in relation to the ICT technologies, in the UK. Spillovers are an essential factor in predicting the sources of innovation and, while their study has been central for many years both in macro and microeconomics, a satisfactory understanding of their role, for both the individual firms and the economy as a whole, has not yet been achieved. This paper introduces an econometric model to estimate the role that knowledge spillovers play in predicting the innovative activities of the UK firms. The economic analysis of the role played by knowledge spillovers in the firms' innovation activities faces many challenges. Spillovers are, in facts, flows of an intangible commodity, innovation knowledge that is useful and necessary, to different aspects of a firm's innovative activity. The first problem concerns the definition of these intangible spillovers. The second obstacle is in the choice of the metrics used to quantify them. The third is the definition of the modalities through which these intangibles diffuse through the economy. A fourth problem is provided by the economic analysis of the direct impact that these flows of intangible knowledge exert on the receiving firms. This is particularly challenging as the firms' exposure to these externalities is not mediated through market interaction and prices. The fifth issue involves the indirect, strategic impact that spillovers have on the profitability of a firm. Spillovers often change a firm competitors' efficiency as well as the firm's own one. These relative efficiency effects will have a different net impact, depending on the interaction between these spillovers and other firm's specific characteristics that may act either as complements or as barriers to the absorption of the innovation knowledge. This paper deals with these challenges, and provides estimates on the spillovers impact on the prediction of innovation based on data emerging from the CIS-UK surveys.

ID316 Lawrence Vanston (Technology Futures, Inc) - Gigabit Broadband Access: Status, Forecasts and Observations
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Abstract: Residential broadband access at data rates of 1 gigabit per second is being deployed by providers, such as Google Fiber, in selected areas, such as parts of Kansas City and Austin in the U.S. Although Gigabit service is currently available to only a small fraction of homes, a number of new projects are planned. This paper reviews the status of Gigabit service in the U.S., the motivations of the players, and the drivers and constraints for its continued deployment and adoption. We also present historical data and forecasts on the generations (characterized by typical data rates) of broadband access, which puts the adoption of Gigabit service in context. We conclude that, while Gigabit may be premature in terms of its data rate, there are technical, strategic and marketing reasons why it is likely to grow.

ID239 Mohsen Hamoudia (Orange - France Telecom Group) – *Econometric Modelling and Forecasting of Mobile* **4G-LTE market**

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Abstract: The majority of developed countries are embracing the 4G-LTE data revolution and the market has evolved considerably since the launch of the first network in Sweden in 2009. It is now moving to a more mature phase of development in some countries (South Korea, the US, Japan) with around 260 commercial LTE networks in operation as of today. On the other hand, the take-off of 4G-LTE in the emerging countries will happen twice as fast as the earlier move to 3G. In the majority of studies related to 3G and 4G developments, the growing paths were estimated mainly by diffusion models including Bass models and their various specifications including the multi-generation modeling. In this paper, we propose an econometric modeling which includes explanatory factors from the availability of datasets. This approach links and bridges the 4G-LTE market with its environment and ecosystem with the key drivers and assumptions. Our main finding is that in most cases, the migration to 4G-LTE is happening considerably faster than the earlier migration from 2G to 3G. The first part of this paper will highlight 4G-LTE market's characteristics and emphasis its main drivers in some selected countries. In the second part, we suggest some model specifications and analyze the accuracy of estimated models. Finally, we compare our forecasts to others generated by alternative models from other sources.

APP6   Forecasting practice I
Date: Monday June 30, 4:30-5:30pm
Venue: Van der Vorm
Chair: Daumantas Bloznelis (Norwegian University of Life Sciences)

ID78   Magdalena Cornejo (Buenos Aires University and Di Tella University)
Out-of-sample testing price discovery in commodity markets: the case of soybeans, Co-author: Hildegart Ahumada, Di Tella University
E-mail: mcornejo@utdt.edu
Abstract: Price discovery, a central function of futures markets, has been usually tested in-sample by studying the common stochastic trend between spot and futures prices. However, uncovering the fundamental value depends on supply and demand determinants and also on monetary, financial and exchange rate variables. To evaluate futures as anticipatory prices, we develop a forecast approach to out-of-sample test price discovery in a multivariate framework. We apply it to the soybean market. Results indicate futures prices as the best available "predictors" of future spot prices. However, this finding holds only on average and not for every forecasted period. Moreover, using impulse indicator saturation we empirically detect highly significant time-varying biases. Futures prices have been less helpful for price discovery during the financial crisis started in 2008.

ID287 Alexander Apokin (Center for Macroeconomic Analysis and Short-term Forecasting) – *Modelling and forecasting production capacities for the world economy*, Co-author: Irina Ipatova, CMASF
E-mail: alexander.apokin@gmail.com
Abstract: New normal is the word for a post-crisis slowdown of the global economy. From the stem point of view of economic policy it is crucial if the slowdown is demand- or supply-driven? The former implies demandbased stimulation will succeed, the latter suggests that the only effect is overheating and more inflation, so the focus should be on structural policies. This research project aims at correct estimation of production capacities of the global economy as a whole and several large developed and developing economies (including US and euro area). Also we want to concentrate on drivers for this capacity, including final demand fluctuations and economic policy variables. To model and estimate that, we need to compile various instruments for both macroeconomic and sectoral estimation of production capacity (including filtering, production function approach and stochastic frontier analysis). Some of the required data need to be estimated to make statistics on different countries comparable. We aim to develop novel methods for such estimation. Literature on the subject is not rich in papers compiling different methods to estimate production capacity. Also, usually cyclical factors and economic policy variables infuence on production capacity are ignored. We aim to account for all these factors in our estimation.

ID169 Daumantas Bloznelis (Norwegian University of Life Sciences) – *Forecasting salmon price in the short run*
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Abstract: Price forecasting plays a vital role in the highly volatile environment of salmon farming industry. However, relevant academic contribution is lacking, as previous studies are scarce and rather outdated. Therefore, we take the challenge to forecast salmon spot

price employing a bouquet of popular methods on multivariate, weight-class-specific weekly data for 2007-2014. Vector ARIMA, dynamic factor model, artificial neural network and nearest neighbour method are used, among other. Predictive ability of salmon futures price is also assessed. We consider combining forecasts with different weighting schemes. Simple, trimmed- and winsorized means, AIC- and BIC-weights and Mallows model averaging are utilized. Optimal weight-class-specific forecasts are selected, which may serve salmon farmers, processors and other market participants in enhancing their operations.

APP7   Migration
Date: Tuesday July 1, 10:00-11:00am
Venue: Hudig
Chair: Juha Alho (University of Helsinki)

ID358 Jakub Bijak (University of Southampton) - *Forecasting Scottish migration in the context of the 2014 constitutional change debate*, co-authors: Arkadiusz Wisniowski, University of Southampton; Han Lin Shang, Australian National University
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Abstract: Migration to and from Scotland might be affected by the outcome of the 2014 Scottish referendum on the constitutional future of the United Kingdom. This potential change in migration has not been thoroughly analysed to date. The aim of this paper is thus to present a set of predictions of the possible effects of Scottish independence on internal and international migration. In particular, different sources of uncertainty of future migration flows are examined. The presented forecasts are based on the available historical data on migration flows, as well as on the opinions of a panel of experts on future migration trends. Bayesian statistical inference is used to combine different sources of uncertainty in a coherent manner. The results indicate that there is substantial uncertainty about future migration to and from Scotland, which increases with the forecast horizon. The most uncertain flow is international immigration to Scotland. Emigration from Scotland is more likely than not to increase in the near future, whereas migration between Scotland and the rest of the United Kingdom is expected to remain at similar levels to the present, irrespective of the outcome of the 2014 independence referendum.

ID353 Juha Alho (University of Helsinki) - *Multiregional multistate migration models*
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Abstract: Geographic regions and other states such as household status can sometimes be modeled using identical models. However, in many cases the data available for their description are very different. We formulate a model in which regional migration is described in terms of full region-to-region intensities of flows, but changes in states are described in terms of their prevalences, or shares, by age and sex. The time evolution and forecasting of the intensities and of the prevalences require different strategies. An application of such models for China is outlined.

APP8   Forecasting practice II

Date: Tuesday July 1, 11:25am-12:45pm
Venue: Van der Vorm
Chair: Miriam Scaglione (University of Applied Sciences and Arts Western Switzerland Valais)

ID177   Dirk Drechsel (KOF, ETH Zurich) - *Forecasting Construction Investment: A Bayesian Model Comparison and Mixed Data Sampling Approach*

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Abstract: Construction investment in Switzerland amounts to 10% of Swiss GDP. Forecasts of construction investment are of significant importance for decision makers analyzing the development of the Swiss economy. We propose a Bayesian model comparison with a mixed data sampling setup to improve construction forecasts based on monthly constructions applications and permits. Such an approach allows for flexibility with regard to assumptions about the distribution, duration and time span of construction investments. Since almost every construction activity in Switzerland requires a permit, these application and permission data are well suited for forecasting Swiss construction investments. When a construction permit is granted by the municipalities after an applicant has filed an application, construction starts several months later. Thanks to this time lag, construction permits can be used to predict the evolution of the construction sector over the next months after the publication of construction application and permission data with a distinct forecast horizon. Two forecasts will be calculated using a monthly construction application data set from 1993 to 2014 and a quarterly data set on construction investments covering 1993 to2012: first, a forecast for total construction investments and second, a forecast for residential construction. A simple linear forecast using construction application and permission data does not take into account the duration of construction investments. For instance, at the start of a housing project only a fraction of investments takes place while the foundation is laid. Thereafter, no investment at all takes place as the foundation has to dry. Then, later on in the construction process large investments take place for erecting the walls, fixing the interior, etc. Therefore construction investments do not follow a uniform distribution. Flexible distributional assumptions of investments over the duration of a construction project are required to model these artefacts. We consider log-normal, gamma and exponential distributions to be appropriate for this task. Different sets of distributions are used in a mixed data sampling (MIDAS) setup in order to utilize high frequency information (monthly construction applications and permits) for forecasting lower frequency realizations (quarterly construction investments). To select between competing models and distributions of investment durations a Bayesian model comparison approach is employed, selecting the models with the highest Bayesian odds ratios based on estimated marginal likelihoods. The combination of Bayesian model comparison with a mixed data sampling setup outperforms several alternative benchmark models.

ID32   Maria Rosa Nieto (Universidad Anahuac Mexico Norte) – *Econometric model using the bootstrap methodology to forecast the unmet demand applied to the airline industry*, co-author: Rafael Carmona Benitez, Universidad Anahuac Mexico Norte

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Abstract: This paper introduces the concept of unmet demand, or the demand that has not been satisfied, for passenger transportation applied to the airline industry. The unmet demand may exist but it is constrain to economic effects of supply and demand. We assume that, in some air transport routes, the total demand has not been satisfied because there are people that could not travel because other reasons such as high ticket fares, but it does not mean they are not demanding services. The importance of estimating the unmet demand or unsatisfied demand is an opportunity to offer more services. This research proposes an econometric model to estimate the possible passenger unmet demand. The model does not assume any specific distribution from the analysis of the behaviour of the air transportation market instead the bootstrap methodology is applied. In this paper, the market size per route is assumed to be equal to the sum of the known demand and the unmet demand. The econometric model is set up by analyzing The United States domestic air transport market (DOT US Consumer Report, 2005-2008) approximately 18,000 routes from origin airport to destination airport per year.

ID58 Daniel Williams (Baruch College-CUNY) - *Explaining State Revenue Forecasting Accuracy*, Co-author: Joseph Onochie, Baruch College-CUNY

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Abstract: This paper builds on past research into revenue forecasting, which shows that under most, but not all, circumstances, publicly disclosed revenue forecasts are biased to underestimation (Blackley & DeBoer, 1993; S. Bretschneider & Schroeder, 1985; S. I. Bretschneider & Gorr, 1987, 1992; S. I. Bretschneider, Gorr, Grizzle, & Klay, 1989; S. I. Bretschneider, Straussman, & Mullins, 1988; Brogan, 2012; Burkhead, 1956; Grizzle & Klay, 1994; Heinemann, 2006; Klay & Grizzle, 1992; Rodgers & Joyce, 1996; Rubin, 1987; Voorhees, 2006; Williams, 2012). A few of these papers provide limited insight into reasons for forecast error, focusing on forecast methods, political motivation, or hedging behavior. Using National Association of State Budget Officer data and a dataset developed by the authors from a variety of public sources, we examine the factors associated with forecast error including revenue type, volatility, overtly political characteristics of the state, the presence of tax and expenditure limitations, and other theoretically interesting elements that can reasonably be expected to influence a preference for an asymmetric loss function. The contribution of this analysis is to more broadly answer questions about the features of the revenue forecasting environment that are associated with underestimation and, less commonly, overestimation.

ID158 Miriam Scaglione (University of Applied Sciences and Arts Western Switzerland Valais) - Forecasting tourism frequentation series using regional grouped time series-The case of the canton of Valais in Switzerland, co-authors: Michele Hibon, INSEAD; Pascal Favre, HES-SO Valais-Wallis/Institute of Tourism
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Abstract: The canton of Valais has 19 different destinations. At the lowest level, tourism frequentation data, namely overnights, are collected for each of its 127 municipalities. The destinations are classified into three majors regions and the overnights sorted into Swiss residents and foreigners. It this way, the hierarchy of time series is composed of a tree of depth equal to 5. When forecasting the total tourism frequentation for the Valais at the aggregate level, the effect of winter holidays is difficult to model in the forecast, i.e., intervention variables. On the one hand, the 26 cantons set school vacation independently but try to stagger them as much as possible. On the other hand, tourists from different cantons have different preferred Valais ski resorts but these preferences are only partially known. The aim of this research is to assess whether the use of regional grouped time series forecast give better forecasts than on the aggregates levels. The ultimate objective of the current research is to find general empirical rules for identifying the level of aggregation that is appropriate for each case: Destination, origins (national or foreign) regions and above all canton.

APP9   Challenges for healthcare analytics
Date: Tuesday July 1, 3:00-4:00pm
Venue: Schadee
Chair: Hans Levenbach (Delphus, Inc.)

ID313   Paul Savage (Iona College) - *Health Care Analytics and the Transformation of the American System*

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Abstract: The American Health Care Industry is facing a fundamental transformation; comparable to the introduction of Prospective Payment or even the formation of the health insurance industry during the Great Depression. Various forms of bundled payment, such as Accountable Care Organizations, are being created to achieve the Triple Aim of higher quality, lower costs, and better patient experience (access). However the transformation is changing the very metrics we depend upon for predictive analytics as may be applied to Regional planning and Competitive Intelligence. No longer can we assume that the prevalence of a disease or condition within a population cohort can be used to forecast resource needs in the future. Actually the interventions of some organizations have reduced the prevalence of heart attack, colon cancer and fractured hips by thirty and forty percent in some communities and technology has accelerated the migration from inpatient care services to ambulatory surgery centers and physician office settings. The Center for Health Care Analytics is undertaking a series of research projects to measure the transformation of markets that have adopted patient centered care models and to develop metrics and models which can describe the expectations to be made in other markets. These predictive modeling efforts have taken a broad Data Scientist perspective, adding value to the transaction data environment with classification methods, pattern recognition, and other techniques in the application of predictive analytics.

ID209 Tae Yoon Lee (SAS Institute Inc.) - *Data Mining Techniques on Big Healthcare Data - A Practitioner's Guide*

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Abstract: Healthcare predictive analytics today requires the processing of big data relating to hospital and patients administrative data, clinical and non-clinical data including patient demographics, disease diagnoses and procedures, patient charges, medical health records, discharge status. This big data needs to be processed and analyzed to extract knowledge for decision-making and cost-saving. Data mining techniques provide a set of tools that can be applied to detect patterns, classifications, hospital transfers, and mortality. In this session we demonstrate data mining techniques including Decision Trees, Logistic Regression, Neural Networks, and Survival Data Mining using an example with hospital data, to identify at which medical state a patient should be transferred to tertiary hospital, and to predict the probability of mortality, and when the next event will occur.

ID122   Hans Levenbach (Delphus, Inc.) - *The Demand Forecasting Process: A New Challenge for Healthcare*

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Abstract: In recent times, the demand forecasting function has become an increasingly important function for Hospital and Hospital Management Organization planners to

master in their patient-centric supply chain organizations. Yet, a proficiency in applying an effective forecasting process to the job is still lacking in most healthcare organizations. Most of the industry still operates under the simplistic notion that a forecast is "just a number". Moreover, they often fail to recognize the essential difference between an unbiased demand forecast and a balanced supply/demand plan in a consumer-driven supply chain. In this presentation, I will examine and challenges some of the common myths surrounding best-in-class practices for achieving improved forecasting performance. Along the way, I will describe a pathway for making quantitatively- challenging processes more accessible and useful to supply chain practitioners. Illustrated with practical career experiences, I will outline a four-tiered program involving (1) the 'big data' issues of data quality and analysis, (2) the 'predictive analytic' process for selecting statistical forecasting solutions, (3) a data-driven approach to forecast evaluation and performance measurement and (4) the reconciliation of models and demand forecasts to support an effective integrated business planning process.

APP10 Healthcare forecasting
Date: Tuesday July 1, 4:30-5:30pm
Venue: Schadee
Chair: Samantha Buxton (Swansea University)

ID194 Kyunghoon Kim (KAIST College of Business) - *Forecasting Annual Lung and Bronchus Cancer Deaths using Individual Survival Times*, co-authors: Duk Bin Jun, KAIST College of Business
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Abstract: This study proposes a proportional hazard model with unobserved heterogeneity to examine factors that account for individual survival times – the number of years a man had before he died or censoring occurred – and derive the number of annual deaths. We applied diagnosis records of patients who have lung and bronchus cancer, the most common cancer in the United States. The result shows that a cohort (diagnosed year) variable significantly affects individual survival times as well as several variables such as age, gender, race, registry, and stage of tumor progression. Furthermore, from segmenting the whole patients into several groups as of age, gender, and race, we observe their survival probabilities within a given period vary from group to group. Using the estimated individual survival probability in each year, we derive annual deaths caused of the cancer, which in accordance with annual deaths in reality. We expect that our study can shed lights on both public and private sectors. For public sector, the results can contribute to allocate the government's health and welfare budget in a more precise way. In case of private sector, for example, our segmentation results can provide guidance to the insurance industry to target customers more specifically as well as to predict the accurate demands of cancer insurance.

ID219 Yorghos Tripodis (Boston University) - *Predicting risk of conversion to Mild Cognitive Impairment*, co-author: Nikolaos Zirogiannis, Indiana University
E-mail: yorghos@bu.edu
Abstract: In Dynamic Factor Models (DFM) the estimated latent index is a weighted average of past and present scores of observed measures. These weights are a function of the between-subject variability as well as the correlation between measures. Measures that are highly correlated will get higher weight. Moreover, measures that show increased between-subject-variability will also receive higher weight. Conventional factor analytic models that focus on cross sectional datasets do not use any information from within- subject-variability over time. Consequently, if we do not account for time variability we may over (under)inflate the weights. We propose a DFM model appropriate for panel datasets which can handle short time series (T<5). This model discounts past observations of measures that are volatile over time. In addition, tests with rates of change that are highly correlated will receive more weight. Due to the high dimensionality of the data, estimation with Newton-type gradient methods is problematic. We introduce the 2CCEM algorithm which makes estimation of the model feasible through a two-cycle iterative process. We partition the parameter space in two sets and use a two cycle iterative approach for estimation of such a large dataset. Each iteration consists of two distinct cycles, both following an EM algorithm approach. At every iteration, estimation of the elements of each parameter set is conducted conditional on the estimates of the previous cycle. Upon convergence we use the Kalman filter and smoother to obtain a dynamic index for every participant at every point in time. Our estimation process allows for the presence of missing observations and

unbalanced panels. We utilized a dataset from the National Alzheimer Coordinating Center (NACC) to estimate cognitive trajectories. We focused on a study sub-sample that has normal cognition at baseline and at least 2 follow-up visits at normal state. For those participants who converted to mild cognitive impairment (MCI) state at a later time point, we only considered their trajectories during their normal state. For those participants who remained normal during the whole observation period, we only considered those with at least 4 visits, and excluded the last two measurements. We then created two balanced groups of different future conversion status matched by age, sex and education. We estimated trajectories for three cognitive domains based on 11 neuropsychological tests: memory, attention/psychomotor speed, and language. Based on a threshold over which the risk of conversion to MCI at a future time period increases, we created a binary variable that characterizes prediction of conversion to MCI. We validated our prediction with actual diagnosis from neuropsychiatrists using logistic regression. Our results show that the memory (OR=3.3, 95% C.I. 2.0-5.3, p-value<.0001) and language (OR=2.2, 95% C.I. 1.4-3.6, p-value=0.0008) indices have high predictive value for assessing future risk of conversion, while the estimated index for attention/psychomotor speed (OR=1.5, 95% C.I. 0.9-2.3, p-value=0.1051) does not. These results highlight the value of the estimated indices since they can be used for a timely diagnosis of a neurodegenerative disease.

ID98 Samantha Buxton (Swansea University) - *Forecasting Pharmaceutical Life Cycles*, co-authors: Marwan Khammash, University of Sussex; Kostas Nikolopoulos, Bangor University; Philip Stern, University of Exeter
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Abstract: This paper discusses the modelling and forecasting of pharmaceutical life cycles. Three different scenarios were found to exist when exploring the difference between the branded and generic life cycles. First after patent expiry, we examine the case where branded sales decline and the generic sales increase (branded then generic), once the patent associated with the branded drug has expired. Then irrespective of patent expiration we examine two further cases. The first is where branded sales are high and generic sales are low (high branded, low generic) and the second is where branded sales are low and generic sales are high (high generic, low branded). Understanding the patterns of brand decline (and the associated generic growth) is increasingly important because in a market worth over £7bn in the UK, the number of new 'blockbuster' drugs continues to decline. As a result pharmaceutical companies make efforts to extend the commercial life of their brands, and the ability to forecast is important in this regard. Second, this paper provides insights for effective governance because the use of a branded drug (when a generic is available) results in wasted resources. The pharmaceutical prescription data comes from a database known as JIGSAW. The prescription drugs that were modelled were those that had the highest number of prescriptions within the database. Six methods were then used to model and forecast the life cycles of these drugs. The models used were: Bass Diffusion Model, Repeat Purchase Diffusion Model (RPDM), and Naïve with and without drift, Exponential Smoothing and Moving Average models. Based on previous research it was expected that the more complex models would produce more accurate forecasts for the branded and generic life cycles than the simple benchmark models. The empirical evidence presented here suggests that the use of the Naïve model incorporating drift provided the most accurate and robust method of modelling both types of prescribing, with the more advanced models being less accurate for all three scenarios examined.

APP11   Political forecasting

Date: Tuesday July 1, 4:30-5:30pm
Chair: Andreas Graefe (LMU Munich)

ID29   Ori Slonim (The Institute for Policy and Strategy at the Herzliya Interdisciplinary Center) - *The influence of contemporary risk-averted culture on forecasting: the case of intelligence*

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Abstract: The proposed presentation is about aspects concerned with intelligence work which are related to forecasting and anticipation of the future, elements which are involved in almost any activity of intelligence assessment. I'm analyzing forecasting and intelligence forecasting as practical products of the intellectual school of modernism, next to operations research and Game Theory. All were designed as a reflection of the intellectual environment of the first half of the 20th century. Change in the global environment that was generated by rapid technological development, globalization and the relative decline in the power of traditional state actors has weaken the validity and the power of forecasts made by using modernist tools and have brought to the development of new type of forecasting which is essentially closer to risk management methods . That development has altered the way which "strategy" and planning are done. I claim that the new environment, which is plagued with multiple active threats, erodes the validity of traditional forecasting (which is still dominant among national defense establishments). In the paper I analyze that traditional forecasting methodology and describe it as a "top-down" benchmark analysis. I argue that the new environment has created a risk-averted culture which is based on "bottom-up" forecasting.

ID351 Andreas Graefe (LMU Munich) - *Combining Forecasts: Evidence on the relative accuracy of the simple average and Bayesian Model Averaging for predicting social science problems*, Co-authors: Helmut Küchenhoff, LMU Munich; Veronika Stierle, LMU Munich; Bernhard Riedl, LMU Munich

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Abstract: The present study shows that the predictive performance of Ensemble Bayesian Model Averaging (EBMA) strongly depends on the conditions of the forecasting problem. EBMA is of limited value when uncertainty is high, a situation that is common for social science problems. In such situations, one should avoid methods that bear the risk of overfitting. Instead, one should acknowledge the uncertainty in the environment and use conservative methods that are robust when predicting new data. When combining forecasts, consider calculating simple (unweighted) averages of the component forecasts. A vast prior literature finds that simple averages yield forecasts that are often at least as accurate as those from more complex combining methods. These results also hold for the use of EBMA for social science problems. A summary of results from the domain of economic forecasting shows that the simple average was more accurate than EBMA in three out of four studies. On average, the error of the EBMA forecasts was 6% higher than the error of the simple average. A reanalysis and extension of a published study, which had the purpose to demonstrate the usefulness of EBMA, provides additional evidence for US presidential election forecasting. For this task, the error of the EBMA forecasts was 31% higher than the corresponding error the simple average. Simple averages produce accurate forecasts, are easy to describe, easy to understand, and easy to use. Researchers who develop new methods for combining forecasts need to compare the accuracy of their method to this widely established benchmark method. Forecasting practitioners should favor simple averages over more complex methods unless there is strong evidence in support of differential weights.

APP12 Energy, environment and climate
Date: Wednesday July 2, 10:00-11:00am
Venue: Hudig
Chair: P. Geoffrey Allen (University of Massachusetts)

ID256 Anett Grossman (GWS) - *Forecasting the 3E's (Environment-Energy-Economy): The Austrian model e3.at*

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Abstract: A lot of energy models have been built to forecast energy demand and supply as well as CO_2 emissions. With most of these models economy plays a minor role since they only focus on selected economic variables such as investment and prices. 3E models provide an integrated view on sustainability. One of these 3E models is the Austrian macroeconomic, multi-sectoral model e3.at. It comprises the environment, energy and economy in one model, and all modules are linked consistently to each other. In contrast to partial (energy) models, the integrative 3E modeling approach allows for quantifying direct and indirect effects in the economy, environment and energy system of different scenarios dealing for example with emission reduction strategies. In e3.at the economy is shown on an industry level and all agents (i.e. consumers, government and corporations) are considered in the modeling framework as stated in the input-output-tables and the system of national accounts. The economic module is completed with a labor market module. Wages, employees and labor productivity are modeled on the industry level and impacts of different emission strategies can be measured in additional or lost jobs by industries. The energy module shows the relations between economic development, energy prices and energy consumption as well as CO_2 emissions. Furthermore, the energy model represents energy supply, transformation and consumption by energy carriers as stated in the energy balance. The environmental module comprises the direct material inputs for twelve categories (main categories: biomass, minerals, fossil fuels) and differentiates between imported and domestic extracted materials. The domestically extracted respectively imported materials are linked to the extracting sector in the input-output-tables respectively importing sector, and fossil fuels are connected to the energy module, too. This modeling approach reveals the impacts, for example, of a reduced use of fossil fuels on the import dependency in monetary and physical terms. The interrelations in the model e3.at are modeled by definitions as well as causal regression analysis. The impulse for the dynamics in the national model is given by a soft link to the global forecasting model GINFORS. The global economic development influences the export demand for Austrian goods and services. This impulse diffuses through the complete model equation system by using the Gauss-Seidel technique. In every iteration, all model equations are computed. The non-linear equation system is solved if the convergence criteria is fulfilled. The solution algorithm is applied year by year for a given but extendible time span. The Austrian model has been used in different projects e.g. funded by the Austrian Climate and Energy Fund for forecasting the 3E's as well as for calculating and evaluating scenarios with a focus on development of renewable energy and energy efficiency.

ID86   Jonathan Farland (DNV GL Energy) - *Zonal and regional load forecasting in the New England wholesale electricity market: A semiparametric regression approach*, Co-author: Bernard Morzuch, University of Massachusetts

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Abstract: We use a regression-based forecasting approach to model electricity demand as a function of calendar, lagged demand, and weather effects. We explore the nonlinear relationship between electricity demand and weather with penalized splines in a semiparametric regression framework. The equivalence between penalized splines and the special case of a mixed-model formulation allows for model estimation with currently available statistical packages such as R, STATA, and SAS. Historical data are available for the entire New England region as well as for the smaller zones that collectively make up the regional grid. We explore whether aggregating the collective zonal forecasts leads to better forecasting performance than a grand forecast produced from a single regional model. Prior to this research, neither the applicability of a semiparametric regression-based approach toward load forecasting nor the potential improvement in forecasting performance resulting from zonal load forecasting had been investigated for the New England wholesale electricity market.

ID182   P. Geoffrey Allen (University of Massachusetts) - *Are global climatemodels (GCMs) mis-specified?,* Co-authors: Robert Fildes, Lancaster University Centre for Forecasting; Nikolaos Kourentzes, Lancaster University Centre for Forecasting

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Abstract: Decadal forecasting is regarded as a current "hot topic" among meteorologists. Methodologically it falls between weather forecasting, where specifying initial conditions is important, and climate forecasting, where accurate representation of constraints is important (such as forcings of greenhouse gases). Horizons of ten to twenty years allow for pseudo out-of-sample forecasts, or hindcasts, for tests of forecast accuracy, and for comparison with forecasts from other methods. With one or two notable exceptions this does not appear to be the path followed. Rather, simulations compare such things as the effect of different initialization routines. Nor is there much evidence of using forecast accuracy as a basis for model improvement. When decadal climate predictions from a GCM fail to 'encompass' the predictions from alternative models, we can conjecture that the GCM is mis-specified. The structure of alternative models can be used to suggest the type of mis-specification and routes for improving its predictions.

APP13 Transportation
Date: Wednesday July 2, 10:00-11:00am
Venue: Ruys
Chair: Yiannis Kamarianakis (Arizona State University)

ID33   Maria Rosa Nieto (Universidad Anahuac Mexico Norte) – *Econometric models based on passenger's distribution functions to forecast the possible air passenger demand in new routes*, Co-author: Rafael Carmona Benitez, Universidad Anahuac Mexico Norte

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Abstract: This paper analyzes the airline industry passenger transportation demand with the objective of forecasting the demand in routes that do not exist yet. Econometric models and a methodology to determine what routes represent an opportunity to open new services according with the possible market size are proposed. It is important because gives airlines, airports and governments the opportunity to decide what new routes should be opened. Econometric models estimate the possible passenger demand in new routes by dividing the travel distance into ranges. The methodology determines what routes represent an opportunity to open new services according with the possible market size. The econometric models are based on the passenger's distribution function resulting from the analysis of the behaviour of the air transportation market per distance range and they are the distribution functions that better describe the conduct of the airlines pax flow between cities/airports. In this paper, econometric models and the methodology were set up by analyzing The United States domestic air transport market (DOT US Consumer Report, 2005-2008) approximately 18,000 routes from origin airport to destination airport per year.

ID272   Tsung-Hsien Tsai (National Quemoy University) - *An evolutionary model for railway arrival forecasting: application of pattern similarity*

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Abstract: Forecasting is no doubt an important skill that railway operators strive to possess current days in which uncertainty and volatility are becoming more and more common circumstances. In order to utilize perishable resources effectively in the dynamic environment, the concept of revenue management has been proven to be a successful application in the service and transportation industries. The core of RM integrates the functions of forecasting, resource allocation, pricing and overbooking. Among the RM system, forecasting is responsible for providing accurate inputs and may enable operators to have their perishable seats allocated appropriately to avoid either vacancy at the departure day or selling seats to passengers with low willingness-to-pay. As a result, In order to conduct daily operations such as demand management strategies, accurate short-term arrival forecasting for railway operators becomes essential. Conventional time series methods such as exponential smoothing, ARIMA, and neural networks apply historical arrival data to project future arrivals. Nevertheless, this study constructs the forecasting model from another perspective. In fact, as the date is approaching the departure day, abundant booking information is cumulated and stored in the railway database. These booking data can be arranged in to booking curves and are potential for constructing accurate forecasting models. Thus this study aims to utilize booking data directly and proposes an advanced booking model in terms of the concept of pattern similarity. The proposed model contains four modules with distinctive functions for similarity evaluation, instance selection, arrival projection, and parameter

search. Temporal features hidden in the booking data are first extracted to formulate a forecasting procedure. Then the framework of genetic algorithm is adopted to search for unknown parameters and capture the distinctive influence of temporal features. We expect to have the constructed model tested on real daily arrival series and compare its out-of-sample accuracy with that of five benchmarks including pick-up, regression, and their variants. The initial results show that the proposed model may be potential to achieve significant improvement in terms of predictive accuracy comparing with those of the benchmarks. More tests are being done to obtain average performance for generalized conclusions.

ID350 Yiannis Kamarianakis (Arizona State University) - *Real-time vehicular traffic forecasting in urban networks with adaptive LASSO*
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Abstract: This work presents a family of parametric, piecewise-linear spatial time series models for short-term forecasting of traffic variables in vehicular networks. In the adopted framework, separate forecasting models are built for each measurement location in the network. Each model is based on hundreds of potentially useful predictors that contain information from upstream and downstream locations; the significant ones are chosen via a 2-step, penalized estimation scheme, namely adaptive LAD-LASSO. Forecasts from alternative model specifications are combined using a location-specific, regime-switching combination scheme, based on threshold regression. It is shown that the proposed methodology can be applied within the framework of a real-time application that may involve hundreds of measurement locations. Performance for horizons that range from 3 minutes to 1-hour is demonstrated using data from the 2013 TRB traffic forecasting competition.

APP14 Demand forecasting

Date: Wednesday July 2, 11:25am-12:45pm
Venue: Ruys
Chair: Nari Sivanandam Arunraj (Deggendorf Institute of Technology)

ID326 Samaneh Beheshti-Kashi (Bremer Institut für Produktion und Logistik GmbH) - *The Usage of Social Media for Demand Forecasting Purposes for the Fashion Industry*, co-author: Klaus-Dieter Thoben, BIBA
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Abstract: The fashion industry is facing a major challenge in terms of an accurate demand forecasting. Production decisions have usually to be made, before the precise demand information is available. Due to the characteristics of the fashion industry, such as long time-to-market in contrast to short selling periods of fashion products, accurate demand information has become significantly crucial, in order to avoid stock-out and overstocked inventories. Since the fashion industry is a high customer driven industry, this paper presents an approach on how customers' opinions and experiences might be integrated in the demand forecasting process for fashion products. The Web 2.0 enabled an ordinary user or customer to be an active and producing entity. Customers publish content about products, their experiences or trends and distribute their opinions through the various communities. Consequently, companies have the possibility to obtain such information from customers about their brands or products in a completely new way through the Web 2.0. This research is going to investigate the applicability of the integration of social media contents into the forecasting process, in order to identify trends at an earlier time. To do that, this paper focus mainly the following questions : firstly, to investigate whether social media information will result into more precise demand forecasts and to which extent this approach will improve the accuracy of demand figures. The focus of this step is on text data. Therefore, text mining as well as web mining methods will be applied. The second step is the transformation from data to valuable and reliable information. In the last step, it will be investigated how the extracted information can be related to real sales data.

ID188 Yves Sagaert (Ghent University) - Demand forecasting using exogenous leading indicators, co-authors: Nikos Kourentzes, Lancaster Center for Forecasting; El-Houssaine Aghezzaf, Ghent University; Bram Desmet, Solventure
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Abstract: Forecasting is a central input to the demand planning process in modern supply chains. Over- or under-forecasting can have detrimental effects for the operations throughout the organisations, resulting in over-stocking, loss of liquidity or lost sales. Such forecasts are often univariate, although in some cases limited additional information, such as promotions or EPOS data, are also used. Nonetheless, these types of inputs do not capture the state of the market. This is of particular relevance to forecasts with long lead times and tactical planning. Therefore, it might be preferable to build demand forecasts using leading indicators, capturing various aspects of the market that a company operates and the general state of the economy. This is of particular relevance to companies that operate in multiple countries, potentially being at different phases. This introduces a variable selection problem. In this research we evaluate the use of Lasso regression for building demand planning models with leading indicators. We benchmark these against univariate forecasts and causal models with limited inputs.

ID218 Muffasir Badshah (The Dow Chemical Company) - Use of a Linear and Non-Linear Framework in Building a Low-Frequency Structural Forecast Model

with an emphasis on n-step horizon accuracy, Co-author: Santanu Kar, Tata Consultancy Services

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Abstract: It is common for a company such as The Dow Chemical Company to write a contract (for chemical prices) with a 3-6 month binding term. A contract that reflects accurate insights for the next few months, allows negotiating parties to walk away a sense of fair gain and a symbiotic relationship in the future. In this study we consider a chemical that are fairly cyclical and irregular, and is managed actively by producers. Considering this venue, predicting market spot prices accurately for the entire forecast horizon, of course under certain limitations such as Aggregate Economic shocks etc., presents a daunting task for predictive modelers. In order to achieve this goal in this paper, we bridge concepts from Economics (Structural Equations), and Computational Intelligence (Genetic Programming) to formulate low frequency (monthly) forecast models under a linear and non-linear framework. The Demand equation is modeled using Rational Transfer Functions to reflect a delayed lag. In contrast the Supply equation is modeled using distributed lags to reflect the resource market constraints. The demand and supply equations are then combined in a non-linear framework using Genetic Programming along with Raw Materials to produce short term forecasts. Average n-step errors are computed using out-of-sample data to select between competing models. The true rewards (literally and figuratively speaking) are exemplified in the simplicity and robustness of the modeling technique and its real time performance.

ID296 Nari Sivanandam Arunraj (Deggendorf Institute of Technology) – *Time Series Sales Forecasting to Reduce Food Waste in Retail Industry*, Co-authors: Diane Ahrens, Deggendorf Institute of Technology; Michael Fernandes, Deggendorf Institute of Technology; Martin Mueller, Deggendorf Institute of Technology

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Abstract: Food waste is one of the crucial problems along the complete food supply chain (FSC). According to a recent estimate, about 11 million tons of food are wasted every year in Germany during industrial processing, distribution, large consumption and household stages. In Germany, the retail sector produces the food waste of around 0.31 million tons per year. Not only the amount of food waste, but also the link between production and consumption makes the retail sector very important. This study is part of a project which aims at developing a combined forecasting and replenishment system to reduce the food waste in retail sector by 10%, funded by Bavarian ministry for food, agriculture and forest. During distribution and retail stage of FSC, the food waste occurs mainly due to incorrect forecasting of sales which leads to improper ordering of products. Therefore, using an efficient sales forecasting system is a basic and significant measure to reduce food waste. While developing such a time series sales forecasting system, the important usual components considered are level, trend, and seasonality. Other than these time series components, the sales of food products are highly influenced by many factors such as promotions, discounts, holidays, and weather. In this study, the daily sales data of a perishable food from discount retail stores in Lower Bavaria, Germany are used for the analysis and to justify the forecasting model. First, the effects of influencing factors on sales are quantified using multiple regression analysis (MRA). The effects of weather variables such as temperature, rainfall, and snowfall on sales are also examined separately. Second, Auto Regressive Integrated Moving Average (ARIMA) is used as a forecasting model to predict the daily sales. Finally, the contribution of influencing factors in the improvement of forecasting results and their accuracies is briefly discussed.

APP15 Tourism II

Date: Wednesday July 2, 11:25am-12:45pm
Venue: Van Rijckevorsel
Chair: Haiyan Song (Hong Kong Polytechnic University)

ID28 Egon Smeral Austrian Institute of Economic Research) - *Varying price and income elasticities in a global touristic context: measuring the influence of different growth periods and seasonality*, co-author: Ulrich Gunter, Modul-University, Vienna

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Abstract: Tourism demand studies generally assume that the income and price effects on the demand for tourism remain stable across seasons and growth periods. In contrast to these studies, we examine the anomalies in tourism behavior in terms of varying elasticities. Based on the standard tourism demand model for quarterly tourism exports (inbound in money terms) of six different world regions such as North Europe, Central Europe, South Europe, the Americas, Asia and the Pacific we applied a panel econometric approach to measure potential differences in the price and income elasticities due to seasonal influences and the medium-term speed of growth of the world economy. The panel econometric approach we employed is the panel-corrected standard error (PCSE) estimator, which allows for country-level fixed effects while being robust against heteroskedasticity and serial correlation within panels, as well as contemporaneous correlation across panels. The evidence clearly demonstrates that the price elasticities show seasonal variations, especially between winter and summer season in South Europe due to the seasonally dependent different competitive position, which is more or less balanced out in Central and North Europe as well as in the other world regions. In terms of income elasticities, significant differences between summer and winter season were measured for the Pacific because of the seasonal dependent changes in travel behaviour, also partly due to the established summer vacation in the northern hemisphere. Related to the different growth periods the income elasticities showed the most significant variations. In the growth period 1977-1992, we measured for all world regions the highest income elasticities. In the period afterwards until 2003, the income elasticities decreased with the gradually decreasing growth rate of the overall world economy, then in the period until 2012 the income elasticities increased, but stayed significantly below the values of the first period. Obviously, in this period relatively cheaper airfares as well as the generally increasing travel intensity balanced out the negative effects of lower growth rates than in the periods before in the economies considered.

ID162 Zheng Cao (University of Surrey) - *Forecasting International Tourism Demand: A Global VAR Approach*, co-authors: Gang Li, University of Surrey; Haiyan Song, The Hong Kong Polytechnic University

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Abstract: The current study aims to fill the void that no research has been conducted on evaluating the forecast performance of GVAR in the tourism context. Quarterly data covering 25 major tourism destination countries/regions are collected from IMF's International Financial Statistics Yearbook and respective statistics authorities. Data spanning from 1986Q to 2009Q4 are used for modelling, which is a two-stage process. In the first stage, country-specific vector error correction (VEC) model is estimated for each individual destination. In the second stage, the individual VEC models with coefficients estimated are stacked and rearranged as a global demand system. One-

quarter-ahead and four-quarter-ahead out-of-sample forecasts for each country's tourism exports and tourism imports are then generated over 2010Q1-2011Q4. For comparison, the VEC model will be used as a benchmark.

ID129 Andrea Saayman (North-West University) - *Evaluating Non-Linear Approaches In Forecasting Tourist Arrivals*, co-author: Ilse Botha, University of Johannesburg

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Abstract: Internationally, forecasting tourist arrivals have attracted lot of attention from both researchers and practitioners. Two reviews of the academic contributions to this field were completed by Witt and Witt (1995) and Song and Li (2008). Both reviews indicated that quantitative methods to forecasting tourist arrivals are more popular than qualitative methods. These quantitative methods can be sub-divided into two groups, namely causal methods and non-causal methods. Causal methods are regression models which are used to forecast tourism demand by estimating the relationship between tourism demand and the explanatory variables used (Chu, 2004:210). Non-causal (univariate) time series methods remain popular tourism forecasting tools due to the accuracy of their forecasting ability and their general ease of use. Since tourist arrivals exhibit a degree of seasonality, SARIMA models are often found to be the most accurate. However, these models assume that the time-series is linear. This paper compares the baseline seasonal Naïve and SARIMA forecasts of a seasonal tourist destination faced with a structural break in the data collection, with alternative non-linear methods, with the aim to determine the accuracy of the various methods. These methods include the baseline structural model (BSM), smooth transition autoregressive model (STAR) and singular spectrum analysis (SSA). The results show that the non-linear forecasts outperform the other methods in both the short- and long-term forecasts. The linear methods show some superiority in short-term forecasts when there are no structural changes in the time series.

ID52 Haiyan Song (Hong Kong Polytechnic University) - *Mixed Methods Tourism Demand Forecasting: The Case of Asia Pacific Visitor Forecasts*

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Abstract: This paper reports the methods used in a forecasting project that involves forecasting a large number of visitor arrival series within the Asia Pacific region. The project is commissioned by the Pacific Asia Travel Association (PATA), and more than 2000 arrivals and expenditure series are to be forecast in the exercise. To ensure the accuracy of the forecasts, a mixed method that combined both quantitative and qualitative forecasting will be used. A robust model selection process is also implemented to ensure the efficient and unbiased estimates of the forecasting models.

APP16 User experience of forecasting support systems

Date: Monday June 30, 4:30-5:30pm
Venue: Van Weelde
Chair: Stavros Asimakopoulos (Lancaster University)

ID34 Jorge Alvarado (Pontificia Universidad Javeriana) - *Where do practitioners look at in judgmental forecasting? An eye-tracking study*

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Abstract: An eye-tracking study was conducted on 41 forecasting practitioners when judgmentally forecast (with and without computer forecasting suggestion) in order to assess: a) Which forecasting cues get more attention -and therefore, are more informative for forecasters; b) Which forecasting cues require additional cognitive processing, and c)which transitions between cues are more frequent than expected (in order to detect heuristics). Implications for usability in default spreadsheet graphs and tables (with and without computer suggestion) will be discussed.

ID39 Edward Lusk (Marquette University) - *Time Series Complexity: Implications for Design of Forecasting Systems*, co-author: Monica Adya, Marquette University

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Abstract: In a recent study, we developed a rule-based taxonomy that classifies time series as complex or simple, based on features of the series as proposed in the Rule-based Forecasting model (Collopy & Armstrong, 1992). The taxonomy, when applied to a randomly drawn sample from the M-competition, demonstrated robustness in determining simple and complex time series. This taxonomy opens up numerous opportunities for further research, specifically those impacting the design of forecasting decision support systems (FDSS). In this interactive presentation, we intend to engage participants in setting the direction for future research related to design and use of FDSS in light of simple and complex forecasting tasks. Some issues we propose to consider: Can FDSS be beneficial for all sorts of forecasting tasks or are some too complex for meaningful decision support? Similarly, would simple series benefit from direct use of judgment as opposed to application of FDSS? Could we expect forecasters to use and adjust FDSS-generated forecasts differently for complex versus simple series? These and other questions related to FDSS design will be explored to set future directions for FDSS research.

ID51 Ryan Chipley (SAS Institute) - *What is user experience design, and how can it improve forecasting support systems?*

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Abstract: User experience design has become a buzzword for software development. However, it is strongly rooted in the modern field of human factors and ergonomics which has formally been in practice since the 1940s. First thriving in the military, it became popular among many others interested in making any kind of work, product, or system safer and easier to use. Through the application of knowledge about human abilities and limitations, both physical and cognitive, better user experience could be achieved. A basic tenet of this field has always been the user-centered design process - considering the user first. Such an approach to design has evolved from being a nice-to-have attribute to a necessity. As such, it has become an important point of differen-tiation for technological products and services, including software. General user-centered design principles and practices will be discussed. Their application to forecasting software

will be considered, and anecdotes about the development of the new SAS Forecasting Web Client, from a user-centered design perspective, will be shared.

ID360 Jos van Wolfswinkel (Fourworkx) - *Developing a user interface for forecasting software*, co-author: Taco Jansen, Fourworkx
E-mail: jos@fourworkx.com
Abstract: Real life story on how developing a user interface for forecasting software. The development of the user interface consumes up to 75% of the available time and still leads to regular discussions. It's not just the product, but the way it is experienced by its users that determines the success!

FMT1   The Golden Rule of Forecasting: Conservatism, a unifying theory
Date: Monday June 30, 10:00-11:00am
Venue: Mees
Chair: Kesten Green (University of South Australia)

The presentation of the paper in this session is followed by discussion by Robert Fildes, Robin Hogarth and Paul Goodwin

ID223   Kesten Green (University of South Australia) - *Golden Rule of Forecasting: Be Conservative*, Co-authors: Scott Armstrong, The Wharton School; Andreas Graefe, LMU University
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Abstract: This paper proposes a unifying theory of forecasting in the form of a Golden Rule of Forecasting. The Golden Rule is to be conservative. A conservative forecast is consistent with cumulative knowledge about the present and the past. To be conservative, forecasters must seek all knowledge relevant to the problem, and use methods that have been validated for the situation. A checklist of 28 guidelines is provided to implement the Golden Rule. This article's review of research found 150 experimental comparisons; all supported the guidelines. The average error reduction from following a single guideline (compared to common practice) was 28 percent. The Golden Rule Checklist helps forecasters to forecast more accurately, especially when the situation is uncertain and complex, and when bias is likely. Non-experts who know the Golden Rule can identify dubious forecasts quickly and inexpensively. To date, ignorance of research findings, bias, sophisticated statistical procedures, and the proliferation of big data have led forecasters to violate the Golden Rule. As a result, despite major advances in forecasting methods, there is no evidence that forecasting practice has improved over the past half-century.

FMT2   Forecast combination I

Date: Tuesday July 1, 10:00-11:00am
Venue: Mees
Chair: Jan Lohmeyer (Maastricht University)

ID49   Emilio Zanetti Chini (University of Rome "Tor Vergata") - *Testing and selecting local proper scoring rules*

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Abstract: We provide a frequentist framework to elicit the forecaster's expected utility by introducing an LM-type test for the null of locality of scoring rule underlining the observed probabilistic forecast. The scoring rule is looked as observed transition variable in a smooth transition autoregression in order to nest a known framework. The test behaves consistently with the requirement of the theoretical literature. Applications to US Business Cycle and several economic time series reveals that scoring rules affect the dating algorithm of recessions events and the model-based forecast performances in favor of a nonlinear specification, advocating the importance of a correct score selection; secondly, the locality of the scoring rule underlining the estimated predictive density is shown to be a critical assumption.

ID348 Julio Rebolledo (University of Chile) - *Forecast Breakdowns and Forecast Combinations with Linex and Quadratic Loss for Exchange Rates*

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Abstract: Literature regarding combination of forecasts suggests this modeling as an alternative which can produce robust results compared to single forecast models. In this paper two loss functions,Quadratic and Linex, are employed to asses and compare forecasts. The evaluation of the performance of each projection used to forecast in the combination is in order to justify why drifting from an equal weighting model such as the one proposed by Diebold-Mariano may generate motivating outputs. The results indicate that survey data outperform combined forecast models for exchange rates if using quarterly data at the presence of quadratic loss, however the results using the Linex loss produces results in favor of the combined approach

ID324 Jan Lohmeyer (Maastricht University) - *Are you sure that you took the right model? Estimating Impulse Responses under Model Uncertainty*, co-authors: Franz Palm, SBE-Maastricht University; Jean-Pierre Urbain, SBE-Maastricht University

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Abstract: Are you sure that you took the right model? Estimating Impulse Responses under Model Uncertainty This paper considers the issue of impulse response analysis in the presence of model uncertainty. A common approach in econometrics is to select, using standard model selection procedures, one best fitting model from a set of models that are considered as being possibly appropriate and that have been estimated. This procedure is implicitly based on the goal of finding the 'true' model/data generating process (DGP). However, if the 'true' model is not included in the set of estimating models this goal may be misguided. In this project we focus on how to take model uncertainty into account when estimating univariate impulse responses. More precisely we consider the issue of selecting an approapriate model, or a combination of models, when all the models considered are at best approximations of the true underlying data generating process. As a prototypical example, following the work of Hansen (2005,

Econometric Theory), we study the case of univariate impulse reponse functions based on finite order AR models when the underlying DGP is an ARMA model, which is not part of the set of models considered and estimated. We then compare, both analytically and by simulations, the model selection methods with several estimator averaging methods. Both, the model selection as well as the selection of averaging weights, are based on a number of different criteria and methods like equal weighting, AIC, BIC, FIC, and C_p. Simulation evidence indicates that no model selection method based on different model selection criteria is found to perform notably better (in terms of mean squared error of the estimated impulse responses) than the rest over a large range of the parameter space. Preliminary relust show that averaging methods (among other least squares averaging) stabilizes the estimators and should be preferred to selecting a single model from the set of models entertained. This work serves as a basis for the study of averaging methods when the goal is to estimate impulse response functions in multivariate time series models. Future work will provide a theoretical basis for the findings and generalize to multivariate models like VAR's. Among other applications, such analyses may prove valuable for the field of policy evaluation.

FMT3   Density forecast combination
Date: Tuesday July 1, 11:25am-12:45pm
Venue: Mees
Chair: Thomas Götz (Maastricht University)

ID250 Stefano Grassi (University of Kent) - *Dynamic Predictive Density Combinations for Large Datasets*, co-authors: Roberto Caserin, University of Venice; Francesco Ravazzolo, Norges Bank; Herman K. van Dijk, Erasmus University
E-mail: S.Grassi@kent.ac.uk
Abstract: In this paper we aim to contribute to the literature on econometric methods for large datasets. We introduce a Bayesian procedure for time-varying combinations of large sets of predictive densities that can deal with many data. The approach is based on clustering the set of predictive densities in mutually exclusive subsets and on a hierarchical specification of the combination weights. This modeling strategy reduces the dimension of the latent space and leads to parsimonious combinations. For efficient updating of the dynamic weights of the density combination use is made of parallel sequential Monte Carlo filters. We apply our proposed procedure to a large set of predictive densities using macroeconomic data and find substantial gains in point and density forecasting of US real GDP, GDP deflator inflation, Treasury Bill returns and employment over the last 25 years for all horizons from 1-quarter ahead to 5-quarter ahead. The highest accuracy is achieved when the four series are predicted simultaneously using our combination schemes with within and across cluster weights based on log score learning. Furthermore, we found that weights within clusters are very volatile, indicating that individual model performances are very unstable, strengthening the use of density combinations. Finally, we show that the GPU algorithm can reduce the computing time with respect to CPU version of several multiples of CPU time.

ID280   Anne Opschoor (VU University Amsterdam) - *Improving density forecasts and Value–at–Risk estimates by combining densities*, co-authors: Dick van Dijk, Erasmus University Rotterdam; Michel Van der Wel, Erasmus University Rotterdam
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Abstract: We investigate the added value of combining density forecasts for asset return prediction in a specific region of support. We develop a new technique that takes into account model uncertainty by assigning weights to individual predictive densities using a scoring rule based on the censored likelihood. We apply this approach in the context of recently developed univariate volatility models (including HEAVY and Realized GARCH models), using daily returns from the S&P 500, DJIA, FTSE and Nikkei stock market indexes from 2000 until 2013. The results show that combined density forecasts based on the censored likelihood scoring rule significantly outperform pooling based on equal weights or the log scoring rule and individual density forecasts. In addition, using our technique improves VaR estimates at short horizons.

ID190 Gloria Gonzalez-Rivera (University of California, Riverside) – Density Forecast Evaluation in Unstable Environments, co-author: Yingying Sun, Huazhong University of Science and Technology

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Abstract: We propose a density forecast evaluation method in the presence of instabilities, which are defined as breaks in the conditional mean, variance and/or the functional form of the underlying density function. The total sample size (T) is divided into in-sample estimation (R) and out-of-sample evaluation (P). We work with subsamples of size (s) and by rolling the subsample one observation at the time in the evaluation period, we compute a collection of (T-s-R+1) autocontour-test statistics (González-Rivera et al. 2011, 2013) of three different types: t, C , and L , so that we have three sets of tests. We construct a Sup-type statistic by taking the supremum of each of these sets, and an Avg-type statistic by taking the average. Under the null hypothesis of no instabilities, and by using the functional central limit theorem, we derive the asymptotic distributions of these statistics, which are asymptotically pivotal. We also investigate the finite sample properties of the proposed Sup-type and Avg-type statistics. The tests are very powerful in detecting different types of instabilities. We apply our tests to investigate the stability of the density forecast from popular models for the Phillips curve and show the existence of instabilities in the forecasting performance of the models.

ID262 Thomas Götz (Maastricht University) - *Combining distributions of real time forecasts: An application to U.S. growth*, co-authors: Alain Hecq, Maastricht University; Jean-Pierre Urbain, Maastricht University

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Abstract: In macroeconomics many variables are subject to revisions. Take, for example, the quarterly growth rate of U.S. GNP, for which a revised value is published each month. Even after a large amount of quarters there are still a lot of revisions taking place in the growth rates. Apart from many large movements being caused by so-called major revisions, also many smaller adjustments are found frequently, even after a large amount of vintages have already occurred. Instead of making use of the entire history of a revised variable, researchers often solely rely on the latest-available data set. In doing so, a data set is used that is different from the one researchers could have used in real time (Croushore and Stark, 2001). This can have a drastic impact on the development of economic specifications, though. Stark and Croushore (2002) investigate how model selection, i.e., the lag order in autoregressive models, changes as different data releases, or vintages, are considered. Also, measures of forecast accuracy may be deceptively lower when latest-available data are dealt with than when real-time data are used. This makes many of the "horse races", in which different models compete for the lowest root mean squared error (RMSE), questionable. In this paper we consider and extend the repeated observation forecasting approach proposed by Stark and Croushore (2002) by considering an ADL setting, in which the regressors may be sampled at higher frequencies than the regressand. Indeed, economic time series released by statistical offices and other providers of data are very often available in mixed frequencies. It is reasonable to believe that the forecasting performance of a low-frequency series might be improved by making use of the additional information contained in the higher frequency variables (Ghysels et al., 2004). Due to the use of additional regressors, a wider range of approaches may be considered than the ARIMA models of Stark and Croushore (2002). Being equipped with a set of competing models, it will be of interest to analyze whether model selection outcomes based on latest-available data are robust

to the vintage of data that is employed. Given a calendar date and a model specification, the use of each data release leads to a potentially different forecast of the variable of interest. This enables us to produce a distribution of these forecasts, which will be approximated by a continuous density. These model-dependent densities of forecasts are then combined into one density of forecasts per calendar date. We focus on the composition of these combined densities of forecasts through time. The associated weights imply a ranking, which can be compared with the ranking that is based solely on the final vintage of data. Furthermore, these weights present a new weighting scheme that allows the user to incorporate information contained in the revision process into his fore- or nowcasts.

FMT4   Forecast combination and evaluation
Date: Tuesday July 1, 3:00-4:00pm
Venue: Mees
Chair: Victor Hoornweg (Erasmus University Rotterdam)

ID220   Vera Lucia Milani Martins (Federal University of Rio Grande do Sul (UFRGS)) - *Cluster Analysis of Errors in Individual Forecasts*, Co-author: Liane Werner, Federal University of Rio Grande do Sul
E-mail: vlmmartins@yahoo.com.br
Abstract: The combination of forecasts is an approach known for increasing accuracy in forecasting. However, as deeper analyses are carried out, there is no unanimity concerning how many and which forecasting techniques should be grouped. As a result, this paper presents 15 individuals forecasts for a food index series. A cluster analysis was carried out aiming at verifying the clusters of those forecasts, based on the errors generated. The result of such analysis was the identification of three groups, which indicates possible distinct techniques when combining forecasts.

ID221 Wilmer Osvaldo Martinez Rivera (Central Bank of Colombia) – *Evaluating a Set of Forecast Using Small Samples*, Co-authors: Juan Manuel Julio Roman, Central Bank of Columbia; Manuel Dario Hernandez Bejarano, Central Bank of Columbia
E-mail: wmartiri@banrep.gov.co
Abstract: We propose a new procedure to evaluate k≥2 forecasts using small samples. The proposed procedure is based on a modification of Jonckheere's test (1953). We assume that the best forecasts are those whose forecast errors have zero mean, equal variance, non-autocorrelation, are symmetric and unimodal. In testing these hypothesis, we favor non-parametric and non-asymptotic tests. Combining these tests with Jonckheere's, allow us to evaluate forecasts without making any distributional assumptions, which its useful to compare forecast based on small samples. Our procedure has a similar power to Giacomini and White's (2006) and, Mariano and Preve's (2012) tests. Under particular circumstances our procedure is better.

ID128   Victor Hoornweg (Erasmus University Rotterdam) - *Weighing individual observations for time series forecasting*, Co-author: Philip Hans Franses, Erasmus University Rotterdam
E-mail: vhoornweg@ese.eur.nl
Abstract: To predict inflation around the recent credit crunch, it might be better to concentrate on data of the seventies than around the sixties or the nineties. We build on Pesaran, Pick, and Pranovic (2013), who derived optimal weights for one-step-ahead forecasts of a linear regression model. Our automated algorithm determines optimal weights for a large variety of models, it finds the timing of break dates in a less costly manner and without having to specify the number of break dates, and it uses equal weights when necessary. The general idea is to weigh observations based on the accuracy of their pseudo out-of-sample forecasts (posf). First, time periods with similar posf are identified. Second, weights are assigned to those periods based on the accuracy of their posf. Third, individual weights are shrunken towards equal weights, whereby the shrinkage level is again determined by their posf. With a simulation study and an empirical application we show that substantial improvements in forecasting accuracy can be achieved when certain periods in the past receive more influence in the estimation process than other periods.

ID109 Alfred Garloff (IAB) - *Optimal prediction with hierarchically constrained forecast combinations*, Co-author: Norbert Schanne, Institute for Employment Research; Rudiger Wapler, Institute for Employment Research

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Abstract: In this paper, we develop a new approach to combine disaggregate forecasts optimally at different levels in a system of hierarchically constrained forecasts. We start in a situation where we have an array of forecasts on micro-level variables achieved with different estimation models, which need to be combined to a single prediction for each of the variables. Likewise, we have arrays of model-based forecasts on intermediate levels; variables at these levels can be aggregated from the micro level. To guarantee hierarchical consistency, we require the sum of the forecasts of the micro level to be equal to the forecasts on these intermediate levels Using a regression-based optimal pooling approach, we simultaneously estimate the model weights at the micro and intermediate levels, whereby cross-equation constraints guarantee hierarchical consistency. Doing this, the model-specific weights are determined so as to minimise (the sum of) mean-square losses subject to the constraints. Proceeding in such a way, we link the literature on optimal forecast combinations (see Timmermann 2006; Hsiao/Wan 2014) with the literature on hierarchical consistency (see Hyndman et al. 2011; Fliedner 2001) and particularly add to the latter. In a first application of our new method, we use data on regional employment and unemployment developments in Germany at 4 different levels of disaggregation. All levels are forecasted by eight different time-series models. For all units, we simultaneously combine these models with optimal weights subject to the constraints that the projected values aggregate appropriately across geographical levels. We demonstrate that these hierarchically constrained optimal forecast combinations are at least as accurate as optimally pooled forecasts in which hierarchical consistency is guaranteed through ad hoc adjustments (as for example in Keilman, 1985) and perform only slightly less well than the unconstrained optimal forecasts. Besides the application for geographical areas, the forecast combination method may also be suitable for the prediction of GDP and its components (such as investment, overall consumption, consumption of durable goods etc.), or for the joint prediction of stock market indices, stock portfolios, subfields and single assets.

FMT5   Forecast combination II
Date: Wednesday July 2, 10:00-11:00am
Venue: Mees
Chair: Emrah Gulay

ID10 Wendun Wang (Erasmus University Rotterdam) - *Weighted averaged least square prediction*, Co-authors: Jan Magnus, Vrije Universiteit Amsterdam; Xinyu Zhang, Academy of Mathematics & Systems Science
E-mail: wangwendun@gmail.com
Abstract: Prediction under model uncertainty is an important and difficult issue. Traditional prediction methods (such as pretesting) are based on model selection followed by prediction in the selected model, but the reported prediction and the reported prediction variance ignore the uncertainty from the selection procedure. This paper proposes a weighted-average least squares (WALS) prediction procedure that is not conditional on the selected model. Taking both model and error uncertainty into account, we also propose an appropriate estimate of the variance of the WALS predictor. Correlations among the random errors are explicitly allowed. Compared to other prediction averaging methods, the WALS predictor has important advantages both theoretically and computationally. Simulation studies show that the WALS predictor generally produces lower mean squared prediction errors than its competitors, and that the proposed estimator for the prediction variance performs particularly well when model uncertainty increases.

ID18   Andrey Vasnev (University of Sydney) - *A Simple Theoretical Explanation of the Forecast Combination Puzzle*, Co-authors: Gerda Claeskens, KU Leven; Wendun Wang, Erasmus University Rotterdam
E-mail: andrey.vasnev@sydney.edu.au
Abstract: This paper offers a theoretical explanation why forecast combination with the estimated optimal weights has often poor performance in applications. The explanation is simple. The properties of the combination are often derived under the assumption that the weights are fixed while in practice they have to be estimated. If the weight estimation is taken into account during the optimality derivation, the combination might be biased (even if the original forecasts are unbiased) and its variance is larger and no longer guaranteed to be an improvement upon the original forecasts.

ID147 Emrah Gulay (Dokuz Eylul University) - *A Novel Forecasting Combination Technique Balancing Between the Mean and Median Combination Methods*, Co-authors: Serkan Aras, Dokuz Eylul University
E-mail: emrahgulay2011@gmail.com
Abstract: Combining techniques are frequently employed, especially when the researchers forecast the time series data by using forecasting methods each of which has different characteristic features. Combining different forecasting models has been used by those involved in this matter to improve forecast accuracies for a long time. Even though numerous combining techniques have been proposed, the simple combining techniques such as mean and median still maintain their strength, popularity and utility. In this study, a new combination method based on the mean and median combination methods is proposed in order to balance these two methods. The proposed combination technique tries to attain the strong aspects of each method and minimises the risk selected by the method with poor performance. In order to show the ability of the proposed combining method, the well-known six real-world time series are used. The obtained results indicate that the proposed method gives promising performances and achieves balance and also has smaller forecasting error variance.

FMT6   Density forecasting and predictive likelihood
Date: Wednesday July 2, 11:25am-12:45pm
Venue: Mees
Chair: Helmut Herwartz (Georg-August-Universität Göttingen)

ID184 Christian Schumacher (Deutsche Bundesbank) - *Efficient estimation and forecasting in dynamic factor models with structural instability*, Co-author: Dimitris Korobilis, University of Glasgow
E-mail: christian.schumacher@bundesbank.de
Abstract: We develop efficient Bayesian estimation algorithms for dynamic factor models with time-varying coefficients and stochastic volatilities for the purpose of monitoring and forecasting with possibly large macroeconomic datasets in the presence of structual breaks. One algorithm can approximate the posterior mean, and the second algorithm samples from the full joint parameter posteriors. We show that our proposed algorithms are fast, numerically stable, and easy to program, which makes them ideal for real time monitoring and forecasting using flexible factor model structures. We implement two forecasting exercises in order to evaluate the performance of our algorithms, and compare them with traditional estimation methods such as principal components and Markov-Chain Monte Carlo.

ID152 Claudia Foroni (Norges Bank) - *Density forecasts with MIDAS models*, Co-authors: Knut Are Aasteveit, Norges Bank; Francesco Ravazzolo, Norges Bank
E-mail: claudia.foroni@norges-bank.no
Abstract: In this paper, we extend the existent MIDAS approach to obtain density forecast. As a first contribution, we compute density forecasts from different MIDAS models. In particular, we consider the classical MIDAS models and the unrestricted version. We provide Monte Carlo simulations that help comparing the different MIDAS models in terms of their forecasting performance. We find that the results in terms of point and density forecasts are coherent. Moreover, the results are not clearly indicating a superior performance of one of the models under scrutiny, especially when the persistence of the low frequency variable is low. Some differences are instead more evident when the persistence is high, for which the AR-UMIDAS seems to perform better. Finally, we carry out an empirical exercise. We evaluate point and density forecasts computed for the US output growth, by exploiting typical monthly series in real-time.

ID96 Fabian Krueger (Heidelberg Institute for Theoretical Studies) – *Combining Density Forecasts under various Scoring Rules: An Analysis of UK Inflation*
E-mail: fabian.krueger@h-its.org
Abstract: Density forecast combinations have been found to perform better than individual forecasts under the Log Score criterion, suggesting to combine rather than select forecasting methods. We analyze whether this result carries over to alternative scoring rules for probabilistic forecasts: the Quadratic Score (Brier,1950) and the Continuous Ranked Probability Score (Matheson and Winkler, 1976). This question is important since the choice of a specific scoring rule is typically hard to motivate on statistical or substantive grounds. We first present some theoretical results on the performance of combinations under various scoring rules. We then consider a detailed empirical analysis of UK inflation, where the Bank of England's skewed two-piece-normal density is combined with Markov Chain Monte Carlo samples from two Bayesian Vector Autoregressive (BVAR) specifications. We find that combinations outperfom all individual

forecasting methods, except in situations where the Bank's forecasts clearly dominate the two BVARs. Furthermore, our results point to gains from using logarithmic instead of traditional linear density combination methods. In summary, the paper's theoretical and empirical findings suggest that the good performance of density combinations is remarkably robust across three scoring rules.

ID66 Helmut Herwartz (Georg-August-Universität Göttingen) - Risk forecasting in (T)GARCH models with uncorrelated dependent innovations, Co-authors: Benjamin Beckers, DIW Berlin; Moritz Seidel, Deutsche Bundesbank
E-mail: hherwartz@uni-goettingen.de
Abstract: Starting with their introduction by Engle (1982) and Bollerslev (1986) (G)ARCH type models have proven quite useful for the dynamic modelling and forecasting of risk attached to speculative asset returns. While the symmetric and conditionally Gaussian GARCH model has been generalized in a magnifold of directions, model innovations are uniformly presumed to stem from an underlying iid distribution. From an empirical perspective we notice that GARCH implied model innovations are likely at odds with the commonly held iid assumption for a cross section of 18 stock market indices. %Drawing on this observation on the one hand, and noticing the heterogeneity of actual dependence patterns on the other hand, We follow two (complementary) strategies to evaluate the conditional distributions of consecutive GARCH innovations, a nonparametric approach and a semiparametric model class of standardized copula distributions. Modelling higher order dependence patterns is found to improve standard (threshold) GARCH implied conditional value-at-risk and expected shortfall out-of-sample forecasts that rely on the notion of iid innovations.

JUD1   The use of information cues and advice in forecasting

Date: Monday June 30, 11:25am-12:45pm
Venue: Plate
Chair: Robert Fildes (Lancaster University)

ID203 Nigel Harvey (University College London) - *Trust in advisors providing risk information: How well are verbal and behavioural indicators associated?* ,
Co-author: Matt Twyman, University College of London
E-mail: n.harvey@ucl.ac.uk
Abstract: Risk estimates can be considered as probabilistic forecasts of harm arising from engagement in particular activities (e.g., risk of death from snowboarding). People or organizations may decide whether to engage in activities after assessing the risks associated with those activities. Typically, they can obtain risk information from a number of different sources or advisors. Here we report studies of trust in such risk communicators. Models of trust in most areas include at least two main components: trust in the motives (benevolence, integrity, honesty) of an agent (e.g., a source of advice about risk) and trust in the agent's competence (knowledge, abilities). These components converge on a final common pathway that determines trusting or cooperative intentions and actions. This implies that different expressions of trust should not dissociate. However, we report experiments that indicate that people's verbal expressions of trust are not consistently associated behavioural indicators of trust (i.e. the weight put on advice from different sources when making risk judgments). In some cases, there is no association; in other cases, there is a weak positive association; finally, there are cases in which a weak but negative association is observed. People may not have full insight into the degree to which they trust organizations or other people and task-specific factors may affect the degree of insight they have. When we need to assess how much people trust different sources of information, it may be unwise to rely wholly on results of polls, surveys, or questionnaires.

ID170 M. Sinan Gonul (Middle East Technical University) - *Advisor Credibility: Does it Really Matter?*, co-authors: Dilek Onkal, Bilkent University; Paul Goodwin, University of Bath
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Abstract: When externally generated predictions are acquired and used as decision making advice during the forecasting activities of organizations, the characteristics of the source providing this external forecasting advice gains paramount importance. Recent research has revealed that cues leading to the perceived credibility of the source can either be attained through experiencing its past performance or built upon the presumptions and/or the reputation about the source. It was also found that if both presumed credibility and experienced credibility cues are present at the same time, the perceptions of source quality gathered through experience dominated those gained through presumptions/reputation. This paper extends and elaborates on these findings by investigating the individual effects of these two source credibility types by manipulating them on separate experiments. In this respect, two studies were conducted. The first study examined the effects of presumed credibility via three groups i) a control group – no cues about presumed credibility ii) a low presumed credibility group and iii) a high presumed credibility group. Similarly the second study examined experienced credibility again via three groups i) a control group – no cues about experienced credibility ii) a low experienced credibility group and iii)a high experienced

credibility group. Findings from both studies are reported along with some guidance for further work.

ID113 Fotios Petropoulos (Lancaster University) - *Do 'big losses' in judgmental adjustment affect experts' behaviour?*, Co-authors: Robert Fildes, Lancaster University; Paul Goodwin, University of Bath
E-mail: f.petropoulos@lancaster.ac.uk
Abstract: Poker players' behaviour has been proved to change after winning or losing a significant amount of money on a single hand (Smith et al., 2009, Management Science). In fact, big losses are followed by playing less cautiously, with players tending to be more aggressive compared to their behaviour after big wins. In this paper, we try to explain the changes in experts' behaviour when performing judgmental adjustments and, in particular, examine the impact of 'big losses'. We define a big loss as the type of judgmental adjustment that effectively decreases the forecasting accuracy compared to the baseline statistical forecast. In essence, big losses are directly linked with wrong direction or highly overshooting judgmental overrides. After exploring relevant behavioural theories, we empirically examine the effect of such big losses using a very large database, concerning forecasts of pharmaceutical products and the respective expert adjustments across multiple countries (Franses & Legerstee, 2009, International Journal of Forecasting). Based on our findings, we expand the discussion of the recent literature with regards to the effective design of forecasting support systems, focusing on the aspects of guidance and restrictiveness.

ID187 Robert Fildes (Lancaster University) - *Factors affecting the use of information and advice in the forecasting process*, Co-author: Paul Goodwin, University of Bath
E-mail: r.fildes@lancaster.ac.uk
Abstract: In business forecasting judgment is known to be a key contributor. The limited behavioural research will be reviewed leading to an abstracted view of the forecasting process which highlights key areas where research should prove productive. The typical forecast in an S&OP forecasting meeting is based on a number of interactions between supply chain personnel where information is exchanged and advice as to what sales are likely is discussed (often this is obtained directly from a forecasting support system). Limitations in this process, such as the reliance on sub-optimal heuristics, used in adjusting statistical forecasts, have seen much recent research: the somewhat conflicting findings suggest we do not yet understand the circumstances when judgmental adjustment is valuable. What information is valued in making adjustments and how do people's prior understanding and motivation affect the interpretation of the information they receive? This presentation introduces some of the factors that influence the interpretation of information and advice in making adjustments and describes a realistic experimental set-up aimed at identifying the key factors.

ID125 Paul Goodwin (University of Bath) - *Judgmental adjustments to forecasts when special events are due to occur: An analysis of information use*, Co-authors: Robert Fildes, Lancaster University; Dilek Onkal, Bilkent University
E-mail: p.goodwin@bath.ac.uk
Abstract: In demand forecasting judgmental adjustments to statistical forecasts are often made to take into account the effects of special events, such as product sales promotions. When making their adjustments, forecasters will have access to a variety of types of information. These include the time series of past sales, the statistical baseline forecast, details of past promotions and their effects and qualitative information relating to the likely success of the promotion, including the opinions and advice of other actors.

This qualitative information can have positive or negative implications for the sales uplift resulting from the promotion. This paper reports on the results of experiments designed to discover how judgmental forecasters make use of this abundance of information. In particular, it will examine: (i) whether they use a non-compensatory strategy, which would involve the use of only one or two cues, or a compensatory strategy where the combined effects of multiple cues is assessed and (ii) how the use of information interacts with incentives for accuracy or the desire to achieve high sales.

JUD2   Judgmental forecasting I

Date: Tuesday July 1, 3:00-4:00pm
Venue: Plate
Chair: Zoe Theocharis (UCL)

ID191 Ville Satopaa (Wharton School, University of Pennsylvania) – *Partial Information Model with an Application to Probability Extremization*, Co-authors: Lyle Ungar, University of Pennsylvania; Robin Pemantle, University of Pennsylvania
E-mail: satopaa@wharton.upenn.edu
Abstract: Randomness in scientific estimation is generally assumed to arise from unmeasured or uncontrolled factors. However, when combining subjective probability estimates, heterogeneity stemming from people's cognitive or information diversity is often more important than measurement noise. This paper presents a novel framework that models the heterogeneity arising from experts that use partially overlapping information sources, and applies that model to the task of aggregating the probabilities given by a group of experts who forecast whether an event will occur or not. Our model describes the distribution of information across experts in terms of easily interpretable parameters and shows how the optimal amount of extremizing of the average probability forecast (shifting it closer to its nearest extreme) varies as a function of the experts' information overlap. Our model thus gives a more principled understanding of the historically ad hoc practice of extremizing average forecasts.

ID195   Shari De Baets (Vlerick Business School) - *An empirical investigation on the value of combined judgmental and statistical forecasting*, Co-authors: Philippe Baecke, Vlerick Business School; Karlien Vanderheyden, Vlerick Business School
E-mail: shari.debaets@vlerick.com
Abstract: Forecasting in practice is often a combination of statistical model forecasting and human judgment (Dalrymple, 1987; Klassen & Flores, 2001; Lawrence et al., 2006; Mentzer & Cox, 1984; Sanders & Manrodt, 1994; Sparkes & McHugh, 1984). While academia point towards the benefits of a statistical approach, business practice continues to rely on judgment. In the turbulent economic environment of today, a combination of both approaches may prove especially relevant. The question remains as to how this combination should occur. This study compares two different ways of combining statistical and judgmental forecasting, employing real-life data from an international publishing company that produces weekly forecasts on the number of magazines sold. We extend previous research in several ways. First, this study compares two methodologies that are able to include human judgment in a forecasting model. In a 'hard judgement' model, expert predictions are incorporated as restrictions in the final optimization model that determines the optimal number of magazines in each outlet. In 'soft judgment' this information is only taken into account as a predictive variable in the demand forecasting process. Moreover, to the best of our knowledge, this is the first study that includes data on both sales numbers and profit margins. Therefore, we can move beyond forecasting accuracy measures such as MAPE or MdAPE, and express forecasting results in profitability. Additionally, this study digs deeper into the value of human judgement forecasting for low and high volatility products. Human judgment has been said to be especially relevant in the context of high volatility due to special events such as promotions (Sanders & Ritzman, 1992). More concretely, an initial forecast of the weekly sales number was made by combining a statistical forecast with judgmental input in a profit optimization model. Hard human judgment proved to be valuable only in

specific cases. Similar to previous literature (Fildes, Goodwin, Lawrence, Nikolopoulos, 2009), negative adjustments were more profitable than positive adjustments. The size of the adjustment had a concave relationship with profitability, i.e. both too small and too large adjustments had a negative effect on profitability. Similar to Sanders & Ritzman (1992), judgmental adjustment was found to be beneficial in high volatility series. In low volatility series, hard judgment damaged accuracy and thus reduced profitability. Incorporating human judgement predictions in a soft way is a methodology that has a positive effect on accuracy and profitability in all scenarios. However, these improvements were incremental and fairly limited compared to the hard judgment model.

ID197 Zoe Theocharis (UCL) - *Judgmental forecasting from hurricane time series*, Co-authors: Leonard Smith, LSE; Erica Thompson, LSE; Nigel Harvey, UCL
E-mail: zoe.theocharis@gmail.com
Abstract: Damages caused by hurricanes are amongst the most catastrophic ones. Forecasting of such events is of paramount importance not just for governments but also for citizens and insurance companies to ensure adequate responses to such threats. Currently, annual hurricane forecasting is mainly carried out via deterministic mathematical models but there are also stochastic approaches to accommodate for longer horizon statistical forecasts. Nevertheless, the process of actual decision-making in these situations also involves a significant judgmental component. How do people use their judgment to forecast number of hurricanes? What factors influence these judgments? This is currently an understudied issue. In a series of experiments we examined how people produce judgmental point forecasts, prediction intervals and density functions. Various findings from the judgmental forecasting literature were replicated. For example, strong anchoring on the last data point gave the impression that forecasters overestimated the sequential dependence in the data series. Also, participants appeared as if they had observed patterns where none existed. Novel results were also obtained. For example, anchoring was stronger when data were presented as line graphs than as unconnected points. Format in which the data series were presented also influenced the shape of the probability density functions people produced for future horizons, with such effects being more pronounced after catastrophic hurricane seasons such as year 2005. These findings have significant implications on how interested parties form their expectations and subsequent decisions in relation to future hurricane occurrences.

JUD3 Judgmental forecasting II

Date: Wednesday July 2, 10:00-11:00am
Venue: Plate
Chair: Shari de Baets (Vlerick Business School)

ID56 George Wright (Strathclyde Business School) - *Evaluation of some of the recent enhancements of the "Intuitive Logics" method of developing scenarios*

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Abstract: First, I establish the common objectives of scenario interventions within organizations and contextualize the well-established, but basic, "Intuitive Logics" scenario development methodology. I next consider recent augmentations of the intuitive logics method and evaluate whether these augmentations enhance the basic method's capabilities. There is a strong case for arguing that these scenario methods address two of three common objectives, namely: (i) enhancing understanding of the causal processes, connections and logical sequences underlying events — thus uncovering how a future state of the world may unfold, and (ii) challenging conventional thinking in order to reframe perceptions and change the mindsets of those within organizations. However, other than in the augmentation in which multi-attribute value analysis is applied to evaluate potential strategies against scenarios, none of the recent developments address directly a third objective: (iii) improving decision making. On this basis, the ubiquitous term "scenario planning" is a misnomer and other "scenario" terminologies might usefully be adopted that more indicate more precisely the process and objectives of scenario interventions.

ID63 Daphne Sobolev (University College London) - *Preservation of properties of asset price series: the role of judgemental forecasting*, co-author: Nigel Harvey, University College London

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Abstract: Numerous forecasting and trading algorithms are based on the assumption that parameters characterising asset price series remain constant over time. For instance, Black-Scholes formula is based on the assumption that assets, which have exhibited random walk behaviour in the past, will continue to show this behaviour in the future. Here we address the question of the nature of the mechanisms that help to preserve market parameters. We used fractal time series to model price series. Fractal graphs are characterised by the Hurst exponent, a measure of the dimension and autocorrelation of the series. In a laboratory experiment, participants (N=34) were presented with a sequence of 45 graphs of such series. At the beginning of each trial, each graph was presented over a fixed time interval. Participants could change the time interval of the presented graph by using a slider. They were asked to choose the time interval they considered the most appropriate for making financial forecasts and then to make those forecasts on the graph for which they had selected the time scale. Two variables were manipulated: the Hurst exponent of the price series (and thus also their local steepness and oscillation) and the required forecast horizon. When making financial forecasts, people chose to scale the given graphs, rather than leave them with the initially presented time interval. The chosen time-scales were strongly and positively correlated with the forecast horizon. Furthermore, the chosen time-scales depended on the local steepness and oscillation of the graphs. Chosen time-scaling factors resulted in scaled graphs, whose local steepness and oscillation were positively correlated with those of the original graphs. We, therefore, concluded that the way participants chose to

scale graphically presented data, preserved properties of the original data. We found also correlations between local steepness and oscillation of the scaled graphs and forecast horizon. Finally, the way participants chose to view the market affected their forecasts. Forecast dispersion can be used as a measure of the market's instability. We obtained that forecast dispersion measures were negatively correlated with the Hurst exponents of the original graphs and positively correlated with the local steepness and oscillation of the data graphs. Our results show that people's forecasts preserve the structure of the given data, and explain this phenomenon through the way people perceive price graphs. Thus our study provides evidence supporting the idea that bid prices encapsulate structural properties of price series.

ID80   Xia Meng (University of Bath) - *Cultural differences in the estimation of judgmental prediction intervals for time series*, Co-authors: Paul Goodwin, University of Bath; Sheik Meeran, University of Bath
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Abstract: Research suggests that judgmental prediction intervals usually exhibit overconfidence in that they tend to be too narrow for the stated coverage probability. Work in other domains suggests that overconfidence is much higher when people have a Chinese, rather than a Western, cultural background. This paper reports on an experiment that was designed to examine whether Chinese people exhibit different levels of overconfidence compared to British people when they are asked to estimate judgmental prediction intervals based on time series data. It was found that the Chinese participants exhibited significantly higher levels of overconfidence. This has potentially important implications for communications within multicultural teams and between trading partners from different cultures. It also suggests that the design of forecasting support systems may need to take into account cultural differences.

ID120   Shari De Baets (Vlerick Business School) - *The role of expertise, context and the forecasting phase in judgmental forecasting research*, Co-authors: Karlien Vanderheyden, Vlerick Business School; Marc Buelens, Vlerick Business School
E-mail: shari.debaets@vlerick.com
Abstract: Companies must increasingly deal with the exponential growth of data and the permanently increasing need for data-driven decision making. However, many are failing to realize the full potential of forecasting analytics in that analytical models are becoming increasingly sophisticated, while forecasting accuracy appears to be declining. For this reason, judgmental forecasting research seemingly lacks the necessary practical impact. We suggest that this might be because of the methodology and research model that currently dominates the field. Extant research has focused on the accuracy of judgmental techniques, statistical models, or both. In this paper, we introduce a new research model that incorporates the analyzability of the problem as a predecessor to the choice of the most suitable technique for forecasting. The expertise of the forecaster and the forecast context in turn determines the analyzability of the problem, considerations largely ignored by existing research given the prevailing methodology of experiments in artificial settings. In addition, we introduce an important moderator in determining the value of judgment in forecasting: namely, the phase of the forecasting process in which judgment occurs.

JUD4   Judgmental forecasting II
Date: Wednesday July 2, 11:25am-12:45pm
Venue: Plate
Chair: Dilek Onkal (Bilkent University)

ID137 Emre Soyer (Ozyegin University) - *Providing information for decision making: Contrasting description and simulation*, co-author: Robin Hogarth, Universitat Pompeu Fabra
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Abstract: Providing information for decision making should be like telling a story. You need to know, first, what you want to say; second, whom you are addressing; and third, how to match the message and audience. However, data presentations frequently fail to follow these simple principles. To illustrate, we focus on presentations of probabilistic information that accompany forecasts. We emphasize that the providers of such information often fail to realize that their audiences lack the statistical intuitions necessary to understand the implications of probabilistic reasoning. We therefore characterize some of these failings prior to conceptualizing different ways of informing people about the uncertainties of forecasts. We discuss and compare three types of methods: description, simulation, and mixtures of description and simulation. We conclude by identifying gaps in our knowledge on how best to communicate probabilistic information for decision making and suggest directions for future research.

ID95 Nigel Harvey (University College London) - *The effect of graph format on judgmental forecasting: Why are forecasts from bar graphs worse than those of line graphs and from unconnected points?*, Co-author: Stian Reimers, City University London
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Abstract: The manner in which data series are presented to judgmental forecasters influences the forecasts that they make from those series. We have been interested in whether there are any differences in forecasts made from bar graphs, line graphs, and unconnected points. At a recent ISF, we reported experiments showing that participants who saw data represented as bar graphs made forecasts that were lower and that contained more noise than those who saw data as line graphs or unconnected points. Their forecast accuracy was significantly worse than that of those in the other two groups. It is possible that people's forecasts are drawn downwards as their attention is attracted towards the solid representation of data provided by bar charts. Here we report experiments designed to investigate this possibility. First, we thought that attention may be drawn more strongly to more heavily shaded bars. However, an experiment, while replicating the original effect, failed to show an effect of depth of shading in bar graphs. Second, we examined graphs of negative data that were depicted beneath the horizontal axis: in the bar graph condition, bars came down from that axis instead of going up from it. If the effect arises because bars attract people's attention and because forecasts are displaced towards the centre of attention, the original effect should be reversed: forecasts should be displaced upwards rather than downwards. This is, indeed, what we found, though the effect was clearly larger for data with downward than with upward trends.

ID60   Shanshan Lin (Zhejiang University) - *Accuracy and Unbiasedness of Judgmentally Adjusted Forecasts in Tourism*, Co-authors: Paul Goodwin, University of Bath; Haiyan Song, The Hong Kong Polytechnic University

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Abstract: This study investigates whether experts' group-based judgmental adjustments to econometric forecasts of tourism demand improve the accuracy, of the forecasts and whether the adjusted forecasts are unbiased. A Web-based forecasting support system (Hong Kong Tourism Demand Forecasting System, HKTDFS) was used to structure the judgmental forecasting procedure and the Delphi method was used to aggregate experts' judgmental adjustments. A range of error measures and statistical tests were employed to evaluate forecast accuracy, while regression analysis was used to investigate whether the statistical and judgmentally-adjusted forecasts were unbiased. The hypothesis tests suggested that, on average, the adjustments of the Delphi panel improved forecast accuracy for all of the 6 selected markets. However, although satisfactory accuracy was achieved, the group-adjusted forecasts were found to be biased for some of the individual markets. In-depth interviews with the Delphi panellists provided further insights into the biases that were associated with the Delphi surveys.

ID132   Mary Thomson (Northumbria University) - *Composite versus Individual Forecasts: An Examination of Performance and Consistency in Inflation Rate Forecasting.* Co-authors, Andrew Pollock, Glasgow Caledonian University; Dilek Onkal, Bilkent University; M. Sinan Gonul, Middle East Technical University

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Abstract: This study describes an evaluating framework for analysing the quality of individual and composite inflation rate forecasts. It is illustrated that composite forecasts, formed by using a simple arithmetic averaging procedure, generally improve on the accuracy of a set of individual forecasts, unless all individual forecasts are perfectly consistent with one another, when performance and consistency are based on Mean Squared Error (MSE) measures. It is also illustrated that the Mean Squared Performance Error (MSPE) of composite forecasts is directly statistically obtained from the MSPE of sets of individual forecasts and Mean Squared Consistency Error (MSCE) between paired sets of individual forecasts. The scale of the improvement of the MSPE of composite forecasts over the average of individual MSPEs depends, inversely, on the magnitude of the MSCEs between the paired sets of individual forecasts. This relationship is also evident with important underlying aspects of performance, such as bias, resolution and error variation. The framework is applied to UK, Q4, Retail Prices Index inflation forecasts published in HM Treasury, Forecasts for the UK Economy, for the period 1998 to 2013.

MAC1 Inflation I

Date: Monday June 30, 10:00-11:00am
Venue: Van Weelde
Chair: Guilherme V. Moura (UFSC)

ID110 Kurmas Akdogan (Central Bank of the Republic of Turkey) – Asymmetric Behaviour of Inflation around the Target in Inflation-Targeting Emerging Markets

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Abstract: We explore the asymmetric behaviour of inflation around the target level for inflation-targeting emerging markets. The first rationale behind this asymmetry is the asymmetric policy response of the central bank around the target. Central banks could have a stronger bias towards overshooting rather than undershooting the inflation target. Consequently, the policy response would be stronger once the inflation jumps above the target, compared to a negative deviation. Second rationale is the asymmetric inflation persistence. We suggest that recently developed Asymmetric Exponential Smooth Transition Autoregressive (AESTAR) model provides a convenient framework to capture the asymmetric behaviour of inflation driven by these two effects. We further conduct an out-of-sample forecasting exercise and show that the predictive power of AESTAR model for inflation is high, especially at long-horizons.

ID112 Yasuyuki Komaki (Nihon University) - Examination of policy effect using calculated inflation expectation by Inflation-indexed bonds

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Abstract: It is important to estimate the policy effect accurately and immediately in order to analysis the past, present and future economy. In this study, we examine whether we can estimate the policy effect accurately and immediately using expected inflation rate (hereafter BEI) which we calculate from Inflation-indexed bonds, in case of Abenomics. After return to power on fall 2012 in Japan, Prime Minister Abe has argued that we adopt a three-pronged strategy consisting of bold monetary policy, flexible fiscal policy and a growth strategy that promotes private investment in order to slough off deflation economy in Japan. We call a series of policy as Abenomics. We confirm the policy effect successively. In fact, Abenomics make expected inflation climb significantly. But we find the effect of easing policy under previous administration is larger than Abenomics. We suppose rise of expected inflation in Abenomics is caused by our expectation affected by the change of government mainly. We put our hopes to previous administration too much. After change from Liberal Democratic Party Government on Sept 2009, we expected that Japanese old system was improved and economy recovered immediately. But we disappointed the Democratic Party Government largely. So we desire that return to power lead to better situation than previous. At the moment, we come out of wildly excitement for Abenomics. In fact, after May 2013, expected inflation level off or is rather decline. It is possible to estimate policy effect accurately and immediately using calculated inflation expectation. But we have only 20% of outstanding in the Japanese current market. We should pay attention to use BEI as the expected inflation, as it is not possible fully to make the adequate price formation.

ID142 Guilherme V. Moura (UFSC) - *Inflation Forecasting in a Changing Environment*, co-author: Douglas Eduardo Turatti, UFSC

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Abstract: Inflation dynamics and its volatility have changed over the last decades. Following the Great Inflation of the 1970s, central banks of developed countries have made successful efforts not only to lower, but also to stabilize inflation. These efforts have contributed to what has been called Great Moderation, therefore, it has been hard to use a single model to forecast inflation in different periods of time. In order to cope with this changing environment, the unobserved component stochastic volatility model (UCSV) was proposed in the literature, which is based on the traditional local level model with stochastic volatilities added to the variances of the shocks. The stochastic volatility implies that the UCSV model is a IMA(1,1) model with time varying moving average parameter, which allows it to capture the changes in the inflation process. Although the UCSV model forecast capabilities seems very promising, applications in the literature have chosen to calibrate the value of the unknown parameter using full-sample information, precluding a fair out-of-sample forecast comparison with alternative models. One of the reasons for this choice are the difficulties in estimation caused by the introduction of the stochastic volatilities. The presence of stochastic volatilities implies that the model's likelihood function is a multidimensional integral with no closed form solution, requiring the use of numerical integration techniques. In this article, we propose a fast and efficient maximum simulated likelihood estimation procedure for this model, which is based on Efficient Importance Sampling and on a Rao-Blackwellization step. In contrast to other sequential Monte Carlo methods, the proposed procedure provides continuous likelihood approximations, allowing numerical optimization of the log-likelihood function. We use data from the G7 countries to show that the UCSV parameter can be identified in all these data sets and estimates are statistically different from the calibrated values used in the literature. The out-of-sample forecast performance of the estimated model is tested via the superior predictive ability test, and is shown to be statistically superior to forecasts from the AR(1) and random walk models.

MAC2   Large data sets I

Date: Monday June 30, 11:25am-12:45am
Venue: Van Weelde
Chair: Domenico Giannone (Université libre de Bruxelles)

ID93 Michele Lenza (European Central Bank and Université Libre de Bruxelles) - *Conditional Forecasts and Scenario Analysis with Vector Autoregressions for Large Cross-Sections*, co-authors: Marta Banbura, European Central Bank; Domenico Giannone, Universite Libre de Bruxelles and CEPR
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Abstract: Vector autoregressions (VAR) are very flexible and general dynamic linear models. As the number of variables increases, flexibility and generality come at the cost of parameter proliferation. Given the limited sample length of macroeconomic time series, estimation and inference based on maximum likelihood is feasible only for models involving a handful of variables, an issue known as "curse of dimensionality". In this paper, we discuss how the curse can be turned into a blessing by using dynamic factor models (DFMs) or bayesian VARs (BVARs). The DFM methodology consists in summarising the information from a large number of data series in few common factors. The BVAR methodology consists in penalising the likelihood or, alternatively, shrinking the model parameters via prior distributions. We compare both approaches, discuss their estimation and describe how conditional forecasts or scenarios can be obtained using a Kalman filter based methodology. Both DFMs and VARs can be cast in a state space representation and the methodology is particularly well suited for dealing with large data sets. Using a quarterly data set for the euro area we show that (conditional) forecasts and scenario assessments are similar across the DFM and BVAR models.

ID116 Knut Are Aastveit (Norges Bank) - *Have Standard VARs Remained Stable since the Crisis?* , co-authors: Andrea Carriero, Queen Mary, University of London; Todd E. Clark, Federal Reserve Bank of Cleveland; Massimiliano Marcellino, Bocconi University
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Abstract: Small or medium scale VARs are commonly used in applied macroeconomics for forecasting and evaluating the shock transmission mechanism. This requires the VAR parameters to be stable over the evaluation and forecast sample, or to explicitly consider parameter time variation. The earlier literature focused on whether there were sizable parameter changes in the early '80s, in either the conditional mean or variance parameters, and in the subsequent period till the beginning of the new century. In this paper we conduct a similar analysis but focusing on the effects of the recent crisis. Using a range of techniques, we provide substantial evidence against parameter stability. The evolution of the unemployment rate seems particularly different from the past. We then discuss and evaluate alternative methods to handle parameter instability in a forecasting context. While none of the methods clearly emerges as best, some techniques turn out to be useful to improve the forecasting performance.

ID148 Steffen Roman Henzel (Ifo Institute) - *Point and density forecasts for the Euro Area using Bayesian VARs*, co-author: Tim Oliver Berg, Ifo Institute

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Abstract: Forecast models with large cross-sections are often subject to overparameterization leading to inaccurate forecasts. Recent articles suggest that a Bayesian vector autoregression (BVAR) with shrinkage dominates traditional approaches. In this paper we evaluate different variants of the BVAR with respect to their forecast accuracy for euro area real GDP growth and HICP inflation. We consider BVAR averaging, Bayesian factor augmented VARs (BFAVARs), and large BVARs, which differ in the way information is condensed and shrinkage is implemented. We find that: (a) large BVARs produce accurate point forecasts but show a poor performance when the entire density is considered; (b) BVAR averaging shows the opposite pattern; (c) BFAVARs perform well under both evaluation criteria; (d) choosing the degree of shrinkage optimally does not improve forecast accuracy; (e) all variants except for the large BVAR tend to be well calibrated for inflation and poorly calibrated for GDP; (f) these findings are robust to several alternative specification choices.

ID82 Frieder Mokinski (ZEW) - *Forecasting with Bayesian Vector Autoregressions estimated using Professional Forecasts*, co-author: Christoph Frey, University of Konstanz

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Abstract: We propose a Bayesian shrinkage approach for vector autoregressions that uses survey forecasts as additional non-sample information. In particular, we augment the vector of dependent variables by their survey nowcasts, and claim that each variable of the VAR and its nowcast are likely to depend in a similar way on the lagged dependent variables. The idea is that this additional information will help us pin down the model coefficients. We find that the forecasts obtained from a VAR fitted by our new shrinkage approach typically yield smaller mean squared forecast errors than the forecasts obtained from a range of benchmark methods.

ID148 Steffen Roman Henzel (Ifo Institute) - *Point and density forecasts for the Euro Area using Bayesian VARs*, co-author: Tim Oliver Berg, Ifo Institute

MAC3   Business cycles I

Date: Monday June 30, 11:25am-12:45am
Venue: Mees
Chair: Gian Luigi Mazzi (Eurostat)

ID64 Herman K. van Dijk (Erasmus University Rotterdam and VU University Amsterdam) - *Nowcasting the Business Cycle in an Uncertain Environment*, co-authors: Knut Are Aasteveit, Norges Bank; Francesco Ravazzalo, Norges Bank
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Abstract: We introduce a Combined Density Factor Model (CDFM) approach that accounts for time varying uncertainty of several model and data features in order to provide more accurate and complete density nowcasts. By combining predictive densities from a set of dynamic factor models, using combination weights that are time-varying, depend on past predictive forecasting performance and other learning mechanisms that are incorporated in a Bayesian Sequential Monte Carlo method, we are able to weight 'soft' and 'hard' data uncertainty, parameter uncertainty, model uncertainty and uncertainty in the combination of weights in a coherent way. Using experiments with simulated data our results show that soft data contain useful information for nowcasting even if the series is generated from the hard data. Moreover, a carefully combination of hard and soft data, as in the proposed approach, improves density nowcasting. For empirical analysis we use U.S. real-time data and obtainas results that our CDFM approach yields more accurate nowcasts of GDP growth and more accurate prediction of NBER Business cycle turning points than other combination strategies. Interestingly, the CDFM performs particularly well, relative to other combination strategies, when focusing on the tails and it delivers timely and accurate probabilities of high growth and stagnation.

ID67 Peter Martey Addo (Université Paris I - Pantheon Sorbonne) – *Turning point chronology for the Euro-Zone: A Distance Plot Approach*, Co-authors: Monica Billio, Universita Ca'Foscari of Venice; Dominique Guegan, Universite Paris I
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Abstract: We propose a transparent way of establishing a turning point chronology for the Euro-zone business cycle. Our analysis is achieved by exploiting the concept of recurrence plots, in particular distance plots, to characterize and detect turning points of the business cycle. Firstly, we apply the concept of recurrence plots on the US Industrial Production Index (IPI) series: this serves as a benchmark for our analysis since it already exists a reference chronology for the US business cycle, provided by the Dating Committee of the National Bureau of Economic Research (NBER). We then use this concept to construct a turning point chronology for the Euro-zone business cycle. In particular, we show that this approach permits to detect turning points and study the business cycle without a priori assumptions on the statistical properties of the underlying economic indicator.

ID176   Marco Malgarini (IBRE/FGV) - *Synchronisation of economic cycles in Latin America: evidence from the World Economic Survey*, Co-authors: Aloisio Campelo, IBRE/FGV; Renata Carvalho Silva, IBRE/FGV; Marco Malgarini, IBRE/FGV; Johanna Plenk, IFO

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Abstract: The effect of globalization on business cycle synchronization among emerging and industrial economies is not clear-cut: financial and trade integration may be considered to increase cross-border interdependence, but on the other hand fast-growing developing countries are becoming less sensitive than in the past to fluctuations occurring in industrial economies. Moreover, from an empirical point of view, further difficulties arises from the fact that the literature generally looks at synchronization using trended data, from which cyclical signals should be extracted with appropriate statistical filters: however, results may be rather sensitive to the method used to extract the cycle, especially towards the end of the sample, causing further uncertainty about the robustness of the findings. In order to circumvent those problems, in this paper we will look at the issue of business cycle synchronization among emerging and industrial economies using survey data. More specifically, we will use cyclical information extracted from the IFO World Economic Survey (WES), providing qualitative data for over 120 countries worldwide. In the framework of synchronization analysis, WES data may be considered to have several advantages over more standard quantitative measures. More specifically, we show that: they contain no trend, and as such they should not be filtered in order to extract the cyclical components; they are available almost in real time, being released before the end of the reference quarter; they are not revised; they are closely correlated with more standard quantitative measures such as GDP. Our measure of synchronization based on survey data relies on the calculation of pairwise rolling cross country correlation and on the analysis of the first and second moments of their distribution: an increase in average correlation and a decrease in its variance are interpreted as an increase in business cycle synchronization. The analysis refers to the period 1990-2012 and focus on the main Latin American, Euro Area, Asian and G8 economies, considering both intra and between groups synchronization.

ID246 Gian Luigi Mazzi (Eurostat) - *An integrated framework for business cycle analysis with an application to the euro area and its member countries*

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Abstract: This paper presents an integrated framework for the euro area and member countries' business cycle analysis. It relays on an analytical framework called ABCD allowing for a unified treatment of business and growth cycle with the possibility of incorporating also the acceleration cycle. According to this framework we developed a set of historical dating for euro area and member countries based on a simple non parametric dating rule applied to GDP, industrial production and unemployment rate. The series of historical dating are updated quarterly and they are considered final after 4 years. They are complemented by a set of coincident turning points indicators based on MS-VAR models to timely detect the occurrence of turning points. Both historical dating and the coincident indicators provide a variety of descriptive and parametric measures offering a detailed picture of cyclical movements. Such measures include the severity of recessions, the degree of convergence and synchronisation as well as the diffusion of turning points. We use this framework to study the post-recession behaviour of the euro area and its main economies. Finally, we present some ideas for a graphical and easily understandable way to carry out business cycle analysis.

MAC4   Survey forecasts

Date: Monday June 30, 3:00-4:00pm
Venue: Van Weelde
Chair: Daniel Kaufmann (Swiss National Bank)

ID130 Jonathan Wallen (American University) - *Information Rigidity in Macroeconomic Forecasts: An International Empirical Investigation*, co-author: Xuguang (Simon) Sheng, American University
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Abstract: Using Consensus Forecasts data at the micro level, we investigate information rigidities in professional forecasts of inflation and GDP across the G7 countries. We develop a new measure of information rigidity and find that professional forecasters update their information sets every three to four months. From this new measure, we identify a set of stylized facts: information rigidities vary across forecasting horizons, individuals, countries, and time. To explain the state dependency in information rigidity, we explore potential determinants: market volatility, recession, economic uncertainty, and central bank policy. We find that professional forecasters are less inattentive in periods of high market volatility, recession, and economic uncertainty. Furthermore, policy makers may decrease information rigidity through better communication of monetary policy.

ID253 Roberto Golinelli (University of Bologna) - *Inflation Expectations and the Two Forms of Inattentiveness*, co-author: Joshy Easaw, University of Swansea
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Abstract: Recent developments on how to introduce information about survey expectations in macro models asks for a greater understanding of the nature and dynamics of survey expectations of professionals. Hence, the dynamics of their forecast error found in the present analysis give clearer insights into how to generate better general equilibrium macro models and understanding actual inflation dynamics and persistence. Recent models have focused on deviations from full-information rational expectations (FIRE) due to informational rigidities (see, for example, Mankiw and Reis (2002), Woodford (2001) and Sims (2003)). Agents' inattentiveness due to information rigidities are the basis for these recent rational expectation models with information frictions. Different forms information rigidities form the basis of the competing rational expectations models with informational frictions. Firstly, there is the sticky-information model of Mankiw and Reis (2002). Such sticky information expectations have been used to explain not only inflation dynamics (Mankiw and Reis, 2002) but also aggregate outcomes in general (Mankiw and Reis, 2007) and the implications for monetary policy (Ball et al., 2005). The second type of informational friction models (Woodford (2001) and Sims (2003)) argue that agents update their information set continuously but can never fully observe the true state due to signal extraction problem. Interestingly, as pointed out by Coibion and Gorodnichenko (2012), both types of models predict quantitatively similar forecast errors. The purpose of the present paper is consider these rational expectations models with information frictions in light of new, or additional, forms of inattentiveness. Using the simple framework suggested in Coibion and Gorodnichenko (2012), where forecast errors are investigated empirically as deviations from the full-information rational expectations (FIRE), we consider two forms of inattentiveness. In the existing literature the standard inattentiveness arises when the agents try to update their expectations formed in the previous period. We also consider

an additional form of inattentiveness. Typically, in each period, a professional forecaster not only updates their forecast from the previous period but also forms multi-period forecasts. The second form of inattentiveness arises when the agent is trying to distinguish the forecasts between the different horizons. We show that the first form of inattentiveness is a necessary condition for the new second form to exist. We also argue that establishing the second form and distinguishing between the two forms of inattentiveness sheds valuable insights into the type of information rigidities that led to agents inattentiveness and, consequently, which rational expectations model with informational frictions is likely to prevail. We use different survey data of professional forecasters for both the USA and UK. These surveys require professionals to make different types of forecasts and forecast horizons, hence, make an interesting comparison. We find strong evidence for both forms inattentiveness. The empirical results indicate that the forecast errors of professionals' inflation forecast deviates from the full-information rational expectations. However, the deviation is now greater due to the additional form of inattentiveness. There are clear implications for inflation dynamics and also the aggregate economy. Hence, we finally also consider the implications for the dynamics of inflation.

ID277 Daniel Kaufmann (Swiss National Bank) - *Business Tendency Surveys and Macroeconomic Fluctuations*, Co-author: Rolf Scheufele, Swiss National Bank
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Abstract: We investigate the information content of business tendency surveys for key macroeconomic variables in Switzerland. To summarise the information of a large data set of sectoral business tendency surveys we extract a small number of common factors by a principle components estimator. The estimator is able to deal with mixed survey frequencies and missing observations at the beginning and end of the sample period. We show that these survey-based factors explain a relevant share of the movements of key macroeconomic variables. In particular, questions about the current and future expected situation are informative. However, backward-looking questions, that is questions about the situation compared to the previous year, do not contain additional information. We then examine the economic dimension of the data set. Questions about real activity and capacity constraints contain important information. The latter are particularly useful to obtain a monthly real-time estimate of an output gap. Finally, we estimate a dynamic relationship to produce forecasts for our factors and the key macroeconomic variables. It turns out that the predictive ability of our survey-based factor approach is quite encouraging. These forecasts beat relevant benchmarks in a pseudo-out-of-sample forecasting exercise.

MAC5   Structural models and panel data

Date: Monday June 30, 3:00-4:00pm
Venue: Mees
Chair: Anna Pestova (CMASF)

ID319 Eduardo Loria (UNAM) - *Eudoxus: A SVEC model based to forecast and perform structural analysis (shocks) for the Mexican economy*, Co-author: Emmanuel Salas, UNAM, School of Economics

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Abstract: Eudoxus is a SVEC model, built in 2004 in order to do quarterly forecast for the GDP and the unemployment rate for the Mexican economy. It is constructed as an information system that contains the following variables: US Industrial Output (yus), the monetary aggregate M2, Unemployment Rate (u) and the Real Exchange Rate (q). The model fulfills all the correct specification tests. In addition, we proved the stability through the recursive eigenvalues tests, and Chow and Cusum tests. We run the model with Jmulti 4.24 (Lütkepohl and Krätzig, 2009). Despite the fact that Eudoxus is a kind of time series model, it is based on three important theoretical and empirical facts, such as: a) Okun's Law; b) the existence of real effects coming from the monetary policy, and c) the dependency of the Mexican economy to the US Industrial Output, basically since the NAFTA came into effect (1994). Apart of doing quarterly forecast (2 or 3 years in advance) for the last 10 years, its SVEC specification allows to identify the macroeconomic fluctuations through the short and long run restrictions. The model is over-identified with 2 degrees of freedom, LR Test: Chi^2(2.00): 4.9848, Prob: 0.0827. Thanks to the identification, we can claim that: a) there are positive shocks on y, coming from M2, q and yus; b) yus and q are exogenous to the system; c) despite yus affects positively y, it does not affect u; it seems that the transmission mechanism passes through the Mexican GDP, and d) u presents hysteresis. Finally, a forecast analysis is presented (2014.1-2016.4).

ID269 Nariyasu Yamasawa (Atomi University) - *Nowcasting Of Gross Regional Product Of Japan*

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Abstract: It is difficult to capture the present situation of Local government level of GDP, that is Gross Regional Product(GRP). After the 2011 Great East Japan Earthquake, monitoring the economic reconstruction become important. I tried to make 47 prefectures' monthly GRP. Second, I made counterfactual for three (Iwate, Miyagi and Fukushima) prefectures' monthly GRP. I use prime component analysis(PCA) and panel data estimation to construct those data. Then, I measured the indirect cost of the earthquake and impact of the earthquake and found that indirect cost of East Japan Earthquake is small. Because of huge damage of infrastructure and capital stock, reconstruction demand is very large.

ID343 Anna Pestova (CMASF) - *Leading indicators of turning points of the business cycle: panel data analysis for OECD countries and Russia*
E-mail: apestova@forecast.ru
Abstract: The main objective of this paper is to develop leading indicators of business cycle turning points for OECD countries and Russia, in order to reveal common factors of their macroeconomic processes over a long period of time. To predict cycle turning points, leading indicator models with a discrete dependent variable reflecting a business cycle phase (recession or expansion in the simplest case) was constructed. Using the approaches and methods adopted in the literature on leading indicators of financial crises, the problem of the "post-crisis bias" was addressed when developing recession and recovery models. The conducted empirical analysis suggests that the inclusion of financial sector variables into equation can significantly improve the predictive power of the models. We have carried out an analysis of model out-of-sample predictive power. The results of the analysis showed high consistency between the behavior of leading indicators of business cycle phase change and the IMF forecasts (WEO). However, the calculation of leading indicators could be done even earlier than the first release of the IMF forecast.

MAC6   DSGE models
Date: Monday June 30, 4:30-5:30pm
Venue: Mees
Chair: Alain Kabundi (South African Reserve Bank)

ID138 Michal Rubaszek (Warsaw School of Economics) - *Forecasting with DSGE models with financial frictions*, co-author: Marcin Kolasa, Warsaw School of Economics
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Abstract: The paper compares the quality of forecasts from DSGE models with and without financial frictions. We find that accounting for financial market imperfections does not result in a uniform improvement in the accuracy of point forecasts during non-crisis times while the average quality of density forecast even deteriorates. In contrast, adding frictions in the housing market proves very helpful during the times of financial turmoil, overperforming both the frictionless benchmark and the alternative that incorporates financial frictions in the corporate sector. Moreover, we detect complementarities among the analyzed setups that can be exploited in the forecasting process.

ID365   Giovanni Angelini (University of Bologna) - *Forecasting DSGE models under QUASI-Rational Expectations*
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Abstract: This paper investigates the forecasting performance of the class of small-scale New Keynesian Dynamic Stochastic General Equilibrium (DSGE) business cycle monetary policy models under the assumption that the agents are `boundedly rational' and have quasi-rational expectations (QRE). The QRE hypothesis maintains that the agents compute their conditional forecasts by using their `best fitting' statistical model for the variables. The agents' forecasting model is a VAR system when all variables are observed and is a state-space system when some of the variables are unobserved. In particular a QRE-DSGE model is obtained from the baseline DSGE model by suitably augmenting its dynamic structure such that the reduced form solution of the system has the same time-series representation of the agents' forecasting model. This approach provides a `natural' remedy to the typical difficulties DSGE models based on rational expectations have to account for the rich contemporaneous and dynamic correlation structure of the data. The proposed approach suggests a way to connect DSGE and VAR modeling. An application based on U.S data illustrates the advantages of using QRE in terms of forecasting performance.

ID77 Alain Kabundi (South African Reserve Bank) - *Nowcasting GDP growth in South Africa*
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Abstract: This paper predicts the present, the near future, and the near past of economic growth in South Africa from December of 2012 to January 2013. The paper uses a dynamic factor model which contains a large number of determinants of economic growth. The news analysis indicates the importance of soft data in forecasting both variables. In addition, the findings point to the relevance of nowcasting models relative to traditional econometrics models in forecasting the present and the near future. But the traditional models perform much better in predicting the medium and the long-term inflation and current account.

MAC7   Nowcasting I

Date: Tuesday July 1, 10:00-11:00am
Venue: Van Weelde
Chair: Rosa Ruggeri Cannata (Eurostat)

ID200 Romain Houssa (University of Namur) - *Now-casting Economic Activity in South Africa*, co-authors: Daniela Bragoli, Universita Cattolica del Sacro Cuore; Domenico Giannone, Universite Libre de Bruxelles; Michele Modugno, Board of Governors of the Federal Reserve System
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Abstract: Gross Domestic Product in South Africa is released quarterly almost two months after the end of the reference period. On the other hand, many other macroeconomic indicators, constantly monitored by financial markets, are published timely and at a higher frequency. We construct a dynamic factor model, which is updated in real time, in order to exploit the information coming from the more timely real economic aggregates, with the aim of mimicking market participant activities. The model produces forecasts (now-casts) of GDP that are comparable to those of the institutional forecasts. Another important feature of our analysis is that we provide valuable insights on the main characteristics of the South African economy in terms of the relevance and the timeliness of each macroeconomic series analyzed.

ID136 Pilar Poncela (Universidad Autónoma de Madrid) - *Dimensionality: curse or blessing? An empirical assessment when estimating factors in Dynamic Factor Models*, co-author: Esther Ruiz, Universidad Carlos III de Madrid
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Abstract: Based on asymptotic arguments, several authors argue that the usual methods for factor extraction in Dynamic Factor Models turn the curse of dimensionality into a blessing. On the contrary, there is an increasing number of authors that doubts that using an extremely large number of variables to extract the factors always implies larger accuracy. In this paper, we check empirically how the point estimates of the underlying unobserved factors and their associated Mean Squared Errors change depending on the number of variables used in their estimation. We analyse the macroeconomic data set popularized by Stock and Watson (2012) and consider alternative procedures for factor extraction based on Principal Components and the Kalman filter. Our paper differs from previous papers in the related literature in several ways. First, we focus on factor extraction rather than on prediction of a given variable in the system. Second, the comparisons are carried out by implementing the same procedures to the same data. Third, we are interested not only on point estimates but also on confidence intervals for the factors.

ID279 Rosa Ruggeri Cannata (Eurostat) - *A glossary on rapid estimates: harmonisation of terminology for better understanding*, co-authors: Roberto Barcellan, European Commission – Eurostat; Alain Hecq, Maastricht University; Gian Luigi Mazzi, European Commission – Eurostat

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Abstract: Statistics are used as daily reference and source of information to interpret how economic and social phenomena are evolving. During the recent economic and financial crisis a need for timelier statistical information to better monitor the economic situation and to design effective economic and monetary policies has strongly risen. Several statistical offices and international organisations have decided to release timelier estimates by means of statistical end econometric techniques to complement the statistical production process; however, a variety of terms has been used to refer to such estimates. We have tried to clarify "what is what" and to set up a glossary of statistical terms associated to the estimation of key economic indicators. The glossary on rapid estimates aims to qualify terms commonly used, such as flash estimate, nowcast, forecast, in a common framework. It is based on several axes to identify who makes the evaluation, what is evaluated, how and when is the evaluation done. It includes also a set of definitions showing as the several axes are used to uniquely identify a concept. The main objective is to achieve a consensus among practitioners when producing rapid estimates.

MAC8   Large data sets II

Date: Tuesday July 1, 11:25am-12:45pm
Chair: Ard den Reijer (Sveriges Riksbank)

ID174 Marco Ventura (ISTAT) - *Factor Augmented Bridge Models (FABM) and Soft Indicators to Forecast Italian Industrial Production*, co-authors: Alessandro Girardi, ISTAT; Barbara Guardabascio, ISTAT
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Abstract: In this paper we present a new forecasting approach straddling the conventional methods applied to the Italian industrial production index. For this reason, we treat factor models and bridge models as complement, rather than as a competitors, and we put them together in a unique model. We follow this approach in order to improve upon the bridge, the good performances of which are well documented, by exploiting a very great amount of survey data on manufacturing activity. This kind of data is characterized by timely disclosure, even one period ahead the release of the target variable, and contains forward looking information. The results are encouraging, as our model outperforms a number of alternative benchmarks, highlighting the positive role of soft data. Different factor algorithms are compared and, under the provision that a large estimation window is used, partial Least Squares, PLS, outperforms Principal Component Regression, PCR.

ID229 Jonas Dovern (University of Heidelberg) - *Does Joint Modeling of the World Economy Pay Off? Evaluating Multivariate Forecasts from a GVAR*
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Abstract: Producing forecasts that are as accurate as possible but also forecasts that are consistent across variables and countries is important for forming a picture of the current state of the world economy that can be used as a basis for forward-looking decisions in economic policy or business. Global vector autoregressive (GVAR) models (Pesaran et al., 2004) capture the dynamics of a large part of the world economy by linking country-specific VAR models to each other using trade-weighted foreign variables that enter each country-specific VAR model as weakly exogenous driving variables. GVAR models offer a flexible tool to model the business-cycle dynamics of the world economy. From an analytical point of view, such models can be used to analyze the effects of a wide range of country-specific or global shocks. From a forecaster's point of view, GVARs offer a tool to produce a comprehensive forecast for the world economy based on one single and consistent model. Surprisingly, to date only few studies analyze aspects of forecasting with GVAR models. Notable exceptions are the following contributions. Pesaran et al. (2009) compare forecasts obtained from GVAR models to forecasts from univariate models and naive forecasts. More recently, Ericsson and Reisman (2012) propose to use impulse indicator saturation to test for parameter constancy in GVAR models to improve their forecast performance. Also recently, Greenwood-Nimmo et al. (2012) use a GVAR model with country-specific intercept shifts to produce probabilistic forecasts for a number of variables in major economies. However, none of these papers analyzes the forecast performance of GVAR models based on multivariate evaluation criteria. Since forecasts for different variables obtained from a GVAR model are jointly determined by construction, a natural approach for analyzing the forecast performance of such models should be based on multivariate evaluation techniques. A number of recent papers have proposed different approaches for this task. Eisenbeis et al. (2002) propose a score measure to rank different multivariate forecasts according to their overall performance. Sinclair et al. (2010) present a method for jointly evaluating direction of change forecasts for a vector of variables. Sinclair and Stekler (2013) use

the Mahalanobis distance as a measure to compare two vectors of random variables, a method that can also be used to construct measures of multivariate forecast performance (see, e.g., Banternghansa and McCracken, 2009; Sinclair et al., 2012b). In this paper, I consider a GVAR model similar to the original version in D´ees et al. (2007a). I use a out-of-sample forecast analysis to assess the forecast performance of the model. I use some of the multivariate methods cited above to compare the performance of the GVAR forecasts to different benchmark predictions based on smaller models. The analysis assesses whether the GVAR forecasts each individual series better than the benchmark models and if the model produces vectors of forecasts that are more consistent than those forecasts based on separate models. In particular, I focus on the forecast performance during the most recent Great Recession.

ID94 Irma Hindrayanto (De Nederlandsche Bank) - Nowcasting and forecasting economic growth in the euro area using principal components, Co-authors: Siem Jan Koopman, Vrije Universiteit; Jasper de Winter, De Nederlandsche Bank

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Abstract: Many empirical studies show that factor models have a relatively high forecast accuracy compared to alternative short-term forecasting models. These empirical findings have been established for different data sets and for different forecast horizons. However, choosing the appropriate factor model specification is still a topic of ongoing debate. On top of this, the forecast performance during the recent financial crisis is not well documented. We investigate these two issues in depth. First, we empirically test the forecast performance of three factor model approaches and report our findings in an extended empirical out-of-sample forecasting competition for the euro area and its five largest countries over the period 1992-2012. Second, we introduce some modifications to the recently introduced collapsed factor model to make it more suitable for real-time forecasting. We show that the factor models were able to systematically beat the benchmark pure autoregressive model in the period before and during the financial crisis. The collapsed dynamic factor model shows the highest forecast accuracy for the euro area and the majority of countries we analysed. The improvement in forecast accuracy of the factor models compared to the benchmark autoregressive model can range up to 77%, depending on the country and forecast horizon.

ID349 Ard den Reijer (Sveriges Riksbank) - *Pooling versus model selection for nowcasting with targeted predictors*, co-authors: Jan Jacobs, University of Groningen; Pieter Otter, University of Groningen

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Abstract: This paper discusses pooling versus model selection for now- and forecasting Swedish GDP growth in the presence of model and data uncertainty. Large macroeconomic data sets are typically unbalanced due to different sampling frequencies and publication delays. We employ a large monthly data set of about hundred monthly indicators with the aim of forecasting quarterly GDP growth rates. We compare the forecasting performance of different types of models based on the complete data set with the corresponding ones based on an optimal subset of selected predictors. The data selection procedure is designed to avoid oversampling and only includes those predictors that reduces the conditional in-sample variance. The different types of models consist of factor models that are designed to handle large data sets and mixed-data sampling (MIDAS) regressions relating monthly factors to quarterly GDP. Apart from predictor selection, model uncertainty relates to factor estimation method, number of factors and lag length. As there are many potential sources of misspecification, one strategy is employ pooling over a large set of models with different specifications. We finally compare the results of pooled versus selected models based on the full sample versus the selected predictors.

MAC9   Nowcasting II

Date: Tuesday July 1, 11:25am-12:45pm
Venue: Van Weelde
Chair: Kajal Lahiri (University at Albany:SUNY)

ID155   Michal Franta (Czech National Bank) - *Density forecasting in simple non-linear models*

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Abstract: The estimation of density forecasts usually draws on linear/linearized models. However, the growing amount of literature suggests that many economic relationships are inherently non-linear. This paper focuses on a prominent example of non-linear relationship – the interaction between financial markets and the real economy. It employs a set of non-linear models consisting of vector autoregressions with time-varying parameters, threshold vector autoregressions with up to four regimes and Markov-Switching vector autoregressions to discuss the accuracy of models and resulting density forecasts. Models are estimated on the US quarterly data covering the period 1984-2012. The real economy is captured by output, short term interest rate and inflation. The model is complemented with a variable representing credit conditions. Results suggest that during the periods of stress events the probabilistic assessment of the economic outlook provided by the non-linear model outperforms the linear version of the model.

ID206   Christian Hutter (Institute for Employment Research) – *Forecasting with a mismatch-enhanced labor market matching function*, Co-author: Enzo Weber, University of Regensburg

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Abstract: This paper takes the labor market matching function as theoretical base for forecasting German job findings. Beyond constant factors such as institutional settings we allow for a time varying efficiency parameter that negatively depends on the qualitative incongruence between job searchers and job openings. In theory, a higher mismatch lowers matching efficiency which increases the risk that the vacancies cannot be filled within the usual period of time. We investigate whether and to what extent forecasts of German job findings can be improved by a mismatch-enhanced labor market matching function. For this purpose, we construct so-called mismatch indicators that reflect regional, occupational and qualification-related mismatch on a monthly basis. In pseudo out-of-sample tests that account for the nested model environment, we find that forecasting models enhanced by the mismatch indicator significantly outperform their benchmark counterparts without indicator. The gain in forecast accuracy can be shown for all forecast horizons ranging between one month and about half a year. It is especially pronounced in the aftermath of the Great Recession where a low level of mismatch improved the possibility of unemployed to find a job again.

ID151 Danilo Leiva-Leon (Bank of Canada) - *Real-Time Nowcasting Nominal GDP Under Structural Break*, Co-authors: William Barnett, University of Kansas; Marcelle Chauvet, University of California Riverside

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Abstract: This paper provides early assessments of current U.S. Nominal GDP growth, which has been considered as a potential new monetary policy target. The nowcasts are computed using the exact amount of information that policy makers have available at

the time predictions are made. However, real time information arrives at different frequencies and asynchronously, which poses the challenge of mixed frequencies, missing data, and ragged edges. This paper proposes a multivariate state space model that not only takes into account asynchronous information inflow it also allows for potential parameter instability. We use small scale confirmatory factor analysis in which the candidate variables are selected based on their ability to forecast GDP nominal. The model is fully estimated in one step using a nonlinear Kalman filter, which is applied to obtain simultaneously both optimal inferences on the dynamic factor and parameters. Differently from principal component analysis, the proposed factor model captures the comovement rather than the variance underlying the variables. We compare the predictive ability of the model with other univariate and multivariate specifications. The results indicate that the proposed model containing information on real economic activity, inflation, interest rates, and Divisia monetary aggregates produces the most accurate real time nowcasts of nominal GDP growth.

ID72 Kajal Lahiri (University at Albany:SUNY) - *Measuring Uncertainty of a Combined Forecast*, co-authors: Huaming Peng, University at Albany; Xugang Sheng, American University
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Abstract: We have argued that from the standpoint of a policy maker, the uncertainty of using the average forecast is not the variance of the average, but rather the average of the variances of the individual forecasts that incorporate idiosyncratic risks. With a slight reformulation of the loss function and a standard factor decomposition of a panel of forecasts, we show that the uncertainty of the average forecast can be expressed as the disagreement among the forecasters plus the volatility of the common shock. Using a new statistic to test for the homogeneity of idiosyncratic errors under the joint limits with both T and N approaching infinity simultaneously, we show that some previously used measures significantly underestimate the conceptually correct benchmark forecast uncertainty.

MAC10 The Fed's forecasts
Date: Tuesday July 1, 3:00-4:00pm
Venue: Van Weelde
Chair: Neil Ericsson (Federal Reserve Board)

ID27 Herman Stekler (George Washington University) - *What have we learned from the Greenbook forecasts?* , co-authors: Tara Sinclair, George Washington University; Jeff Messina, George Washington University
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Abstract: This paper has two objectives. The first is to synthesize the results of the numerous previous evaluations of the Fed's Greenbook forecasts. From this synthesis we are able to derive a set of stylized facts that characterize the qualities of the best US macroeconomic forecasts. Second, we examine the revisions of the forecasts of fixed events to determine how new information is incorporated in the forecasting process. These results appear surprising because in some instances the revisions were in the wrong direction and increased the forecast errors.

ID20 Michael McCracken (Federal Reserve Bank of St. Louis) - *The Effect of FOMC Forecast Disagreement on U.S. Treasuries*, co-authors: Chanont Banternghansa, University of Chicago
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Abstract: In this paper we provide empirical evidence delineating the relationship between FOMC forecasts and yields on U.S. Treasuries. In particular we are interested in whether the FOMC forecasts (measured using the mid-point of the trimmed range) or the disagreement among the FOMC forecasts (measured using the trimmed range) affects yields on U.S. Treasuries. Our empirical strategy follows the event study literature and focuses on the change in yields only on those days in which the FOMC forecasts are released. We consider both daily and intra-daily changes. After accounting for market expectations of the FOMC forecasts we obtain two main results. First, there is no consistent evidence that the FOMC "point" forecasts have any effect on yields. But second, we find statistically significant evidence of an effect on yields due to forecast disagreement. The effect on yields is consistent across all but the longest maturities. The evidence suggests that markets demand higher yields to compensate for uncertain monetary policy viewed through the lens of the FOMC forecasts.

ID23 Neil Ericsson (Federal Reserve Board) - *Greenbook Forecasts and the Business Cycle*, co-authors: Stedman Hood, Federal Reserve Board; Fred Joutz, KAPSARC; Tara Sinclair, George Washington University; Herman Stekler, George Washington University
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Abstract: Building on Sinclair, Joutz, and Stekler (2010), this paper examines the Federal Reserve Board's Greenbook forecasts of U.S. output growth, inflation, and the unemployment rate for potential biases. Standard tests typically fail to detect biases in current-quarter and one-quarter-ahead forecasts. However, impulse indicator saturation (IIS) detects economically large and highly significant time-varying biases for one-quarter-ahead forecasts. Biases depend on the variable being forecast, the forecast horizon, and the phase of the business cycle. IIS defines a generic procedure for examining forecast properties, it explains why standard tests fail to detect bias, and it provides a potential mechanism for improving forecasts.

MAC11 Breaks, nonlinearity and real-time data
Date: Wednesday July 2, 10:00-11:00am
Chair: Katharina Glass (University of Hamburg)

ID74 David Ubilava (University of Sydney) - *On the Relationship between Financial Instability and Economic Performance: Stressing the Business of Nonlinear Modelling*
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Abstract: The recent global financial crisis and the subsequent economic recession have revitalized the discussion regarding the causal relationship between financial and economic sectors. This study examines financial and economic indices developed by the Federal Reserve Banks of Kansas City and Chicago, to identify the impact of financial uncertainty on overall economic performance. Using nonlinear time series models, such as smooth transition and vector smooth transition autoregressions, this research assesses intricate dynamics of the indices, and tests the Granger non-causality hypothesis between the financial stress and economic activity in an out-of-sample setting. Results of this study confirm causal relationship between financial and economic indices. Moreover, nonlinear models outperform their linear counterparts, based on in-sample tests, as well as, out-of-sample forecast evaluations.

ID275   Michael Clements (Reading University) - *Real-Time Factor Model Forecasting and Offsetting the Effects of Instability*
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Abstract: We show that factor forecasting models deliver real-time gains over autoregressive models for US real activity variables during the recent period, but are less successful for nominal variables, and at horizons more than one-quarter ahead. Excluding the pre-Great Moderation years from the factor forecasting model estimation period (but not from the data used to extract factors) results in a marked fillip in factor model forecast accuracy, but does the same for the AR model forecasts. A recent suggestion of continually updating the models' means dramatically reduces forecast bias but does not tend to reduce RMSE forecast loss.

**ID172 Katharina Glass (University of Hamburg) - *Did the Real-Time Information Content of Eurostat's Macroeconomic Data Worsen?* **, co-author: Ulrich Frische, University of Hamburg
E-mail: katharina.glass@wiso.uni-hamburg.de
Abstract: Most macroeconomic data is continuously revised as additional information becomes available. This is a fundamental source of uncertainty about the state of the economy. This paper evaluates the quality of major real macroeconomic variables, published by the Eurostat since 2001 for the Euro area. We use a large real time data set, which contains 156 vintages, covering the period of January 1991 until December 2013. The information content or informativeness of revision depends on degree of uncertainty at time of estimate release and is measured using three methods: descriptive statistics, Signal-to-Noise ratios and Entropy. Our results document continuously growing data uncertainty over the past decade for all real Euro area variables. This finding corresponds Baker et al. (2013b) who detect the increase in economic policy uncertainty during and after the "Great Recession". Moreover we compare our Euro area measures to those based on US data and conclude rising uncertainty for the US data as well. Based on our results we can widen the stylized fact defined by Bloom (2013a): data uncertainty also grows during the recessions.

MAC12 Business cycles II

Date: Wednesday July 2, 10:00-11:00am
Venue: Van Weelde
Chair: Laurent Ferrara (Banque de France)

ID70 Vivien Lewis (KU Leuven) - *Monetary Policy and Labour Hoarding: The ECB vs. the Fed*, co-authors: Maarten Dossche, National Bankof Belgium; Maik Wolters, Kiel Institute for the World Economy
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Abstract: Labour productivity is strongly pro-cyclical in the euro area but a-cyclical in the US. In addition, inflation is more stable in Europe. Both phenomena are consistent with incomplete labour market adjustment - or labour hoarding - in the euro area, as we show in a monetary business cycle model with labour search frictions and unobserved effort. Pro-cyclical labour productivity acts as a counterweight to wage compensation in determining marginal costs, thereby making inflation less volatile. Owing to a more rigid labour market, optimal monetary policy in the euro area is characterised by smoother policy rates. In this way, labour hoarding may help to rationalise the less activist interest rate policy of the ECB relative to the Federal Reserve. Moreover, the zero lower bound on nominal interest rates is less of a concern in Europe than in the US.

ID69 Jan-Egbert Sturm (KOF, ETH Zurich) - *The KOF Economic Barometer, version 2014: A composite leading indicator for the Swiss business cycle*, co-authors: Klaus Abberger, KOF Swiss Economic Institute; Michael Graff, KOF Swiss Economic Institute; Boriss Siliverstovs, KOF Swiss Economic Institute
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Abstract: This paper presents a composite leading indicator for the Swiss business cycle corresponding to the growth rate cycle concept. It is the result of a complete overhaul of the KOF Economic Barometer that has been published by the KOF Swiss Economic Institute on a monthly basis since 1976. In line with tradition, the calculation of the new KOF Barometer comprises two stages. The first consists of the variable selection procedure. In the second stage these variables are transformed into one leading indicator. Whereas in the previous versions of the KOF Barometer six to 25 variables survived the first stage, the new – less discretionary and more automated – version of the first stage is much more generous. Currently, out of a set of 476 variables resulting in 3785 transformations thereof that are tested in the first stage, 214 variables manage to enter the second stage. The increased number of variables underlying the second stage allows a relatively stable and robust KOF Barometer that has hence no longer to rely on filtering techniques to reduce the noise in the final indicator. In a (pseudo-) real-time analysis the characteristics of the new KOF Barometer are compared to the previous versions and other alternatives.

ID199 Norbert Metiu (Deutsche Bundesbank) - *Disentangling economic recessions and depressions*, co-authors: Bertrand Candelon, Maastricht University; Stefan Straetmans, Maastricht University
E-mail: norbert.metiu@bundesbank.de
Abstract: We propose a nonparametric test that distinguishes "depressions" and "booms" from ordinary recessions and expansions. Depressions and booms are defined as coming from another underlying process than recessions and expansions. We find four depressions and booms in the NBER business cycle between 1919 and 2009, including the Great Depression and the World War II boom. Our results suggest that the recent

Great Recession does not qualify as a depression. Multinomial logistic regressions show that stock returns, output growth, and inflation exhibit predictive power for depressions. Surprisingly, the term spread is not a leading indicator of depressions, in contrast to recessions.

ID160 Laurent Ferrara (Banque de France) - *Nowcasting global economic growth: a factor-augmented mixed-frequency approach*, co-author: Clement Marsilli, Banque de France

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Abstract: Facing several economic and financial uncertainties, accurately assessing global economic conditions is a great challenge for economists. The International Monetary Fund proposes within its periodic World Economic Outlook report a measure of the world economic growth that is often considered as the benchmark. In this paper, we put forward an alternative approach to provide monthly nowcasts of the annual global growth rate. Our approach builds on a Factor-Augmented MIxed DAta Sampling (FA-MIDAS) model that simultaneously enables (i) to account for a large monthly database of the global economy, including various countries and sectors, and (ii) to nowcast a low-frequency macroeconomic variable using higher-frequency information. Pseudo real-time results show that this approach provides reliable nowcasts of global GDP growth on a monthly basis.

MAC13 Inflation II
Date: Wednesday July 2, 11:25am-12:45pm
Venue: Van Weelde
Chair: Nobuo Iizuka (Kanagawa University)

ID178 Edward Knotek II (Federal Reserve Bank of Cleveland) - *Nowcasting U.S. Headline and Core Inflation*, co-author: Saeed Zaman, Federal Reserve Bank of Cleveland
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Abstract: Forecasting inflation is difficult, and forecasts of current-quarter inflation suffer from the same difficulties. We propose a new model for nowcasting headline and core inflation in the U.S. price index for personal consumption expenditures (PCE) and consumer price index (CPI). The model relies on relatively few variables and is tested using real-time data. The model's nowcasting accuracy improves as information accumulates over the course of a month or quarter. In head-to-head comparisons, the model's nowcasts of CPI inflation outperform those from the Blue Chip consensus, with especially significant outperformance as the quarter goes on. The model's nowcasts for CPI and PCE inflation also significantly outperform those from the Survey of Professional Forecasters, with similar nowcasting accuracy for core inflation measures. Across all four inflation measures, the model's nowcasting accuracy is generally comparable to that of the Greenbook.

ID254 Carlos Diaz (University of Leicester) - *Conditional term structure of the Canadian inflation forecast uncertainties: the copula approach*, co-authors: Wojciech Charemza, University of Leicester; Svetlana Makarova, University of Leicester
E-mail: cdv7@leicester.ac.uk
Abstract: The work has been stimulated by the earlier rather unexpected findings regarding the lack of correlation between the measures of Knightian macroeconomic uncertainty and inflationary ARIMA-generated forecast errors (that is, non-Knightian uncertainty or Knightian risk) for Canada. For other countries for which data are available such correlations have been significant (except for China). We hypothesize that this is caused by the existence of a relationship between the US and Canadian ex-post inflation uncertainties, which distorts the correlation. In the light of this, we treat forecast errors as realisations of bivariate random variables. We obtain observations by forecasting (and then computing forecast errors for up to 24 steps ahead) from a bivariate vector autoregressive model for the Canadian and US inflation estimated, forecasted and updated recursively. Not surprisingly, a significant Granger causality from the US inflation to the Canadian one (but not the other way around) has been discovered. Following the Inference Function for Margins (IFM) methodology, we first estimate the parameters of the marginal non-normal distributions of inflation forecast errors using the simulated minimum distance method and then we apply the maximum likelihood method for estimation of the copula parameter. Although four copulas are fitted (Gaussian, Gumbel, Clayton and FGM), we have decided to base our inference primarily on the Gumbel copula given its good in-sample. This copula explains well the upper tail dependence, which in our case represents the dependence of inflation during periods of high uncertainty. The preliminary Monte Carlo results indicate a relatively small bias and admissible efficiency of the IFM estimates of the Gumbel copula parameter. On the basis of the estimates of the marginal distributions of forecast errors for subsequent forecast horizons, we have first derived the unconditional term structure

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for the Canadian inflation uncertainty. Next, we approximate the bivariate joint distributions of uncertainties for Canada and US for subsequent forecast horizons. In order to establish the proper dynamic structure for further conditioning, we have examined the uncertainty dynamic dependence matrices, which are copula analogues to the autocorrelation matrix. The main finding is that, for all copulas examined, the statistically significant dependencies are for uncertainties of the same and relatively short forecast horizon. We have evaluated the term structure for Canada under the condition that the US inflation is within the 1% - 3% band. Focusing on the probability of the Canadian inflation being within its own target band (also defined by 1% 3% band), we have found out that the unconditional probabilities decrease from about 87% for August 2011 to around 40% for July 2013. However, the conditional probabilities are markedly lower for short forecast horizons; e.g. for August 2011 is around 71%. With the increase in the forecast horizon, the differences between the conditional and unconditional probabilities diminish. Such differences might have an impact not only on the evaluation of risks of monetary policy in case of policy coordination, but also on pricing of the government T-bills.

ID263   Svetlana Makarova (University College London) - *Term Structure Of Inflation Forecast Uncertainties And Skew Normal Distributions*, Co-authors: Wojciech Charemza, University of Leicester; Carlos Diaz, University of Leicester
E-mail: s.makarova@ucl.ac.uk
Abstract: The work focuses on modelling the distributions of inflation forecast uncertainty with the use of different skew normal distributions, evaluating their term structure, that is differences in distributions of forecast uncertainty for different horizons, and application of the result for constructing of the probabilistic forecasts, presented as fan charts. A new type of skew normal distribution, named the weighted skew normal, which is directly interpretable in relation to monetary policy outcomes and actions, is proposed and its statistical properties derived. This distribution explicitly identifies the elements of ontological uncertainty; that is related to pure randomness (unpredictability) of future events and epistemic uncertainty, expressing incomplete or potentially biased knowledge of the forecasters. The parameters of this distribution can be interpreted as (1) strengths of outcomes of pro- and anti- inflationary economic policy actions undertaken on the basis of experts' forecast signals, (2) accuracy of experts' forecasts aimed at improving on the baseline forecast, (3) thresholds that define the presumed 'safe' region for inflation, that is where monetary intervention is not required, and (4) dispersion of the unobserved 'net' uncertainties, free from monetary policy effects. This distribution is fitted to recursively obtained forecast errors of monthly and annual inflation for 38 countries using data up to February 2013. The forecast horizons vary from 1 to 12 months. It is shown that the inflation forecast errors obtained in such way correlate significantly with more general measures of Knightian macroeconomic uncertainty for most countries for which such measures are available (that is for France, Germany, India, Italy, Spain, UK and US, with the exception of Canada and China, where such correlations are insignificant). The estimation method applied for finding parameters of the fitted distributions is that of the simulated minimum distance with the (twice squared) Hellinger distance criterion. It is found that, for most countries, the weighted skew normal distribution fits inflation forecasts errors better than the two-piece normal distribution, which has been often used for inflation forecasting. Decomposition of the weighted skew normal distribution allows for constructing two types of forecast term structure: (i) representing the historical forecast errors made for different horizons, and (ii) representing the uncertainties which are free from the epistemic element,

identified with the use of the estimated parameters. Both types of the term structure could be applied for different practical purposes, and possibly by different users; the former by the 'end users', who do not have a direct influence on monetary policy, and the latter by central bankers and other policy decision makers, aiming, among other things, at reducing uncertainty through policy action. These two types of the term structure have been evaluated for UK and Poland and used for constructing different probabilistic forecasts, presented in a form of fan charts.

ID126   Nobuo Iizuka (Kanagawa University) - *Exploring Reasons for inflation forecast errors: Evidence from Japan*
E-mail: nobuo-iizuka-0915@kanagawa-u.ac.jp

Abstract: The government debt of Japan has risen rapidly since the late 1990s, driven primarily by the government's optimistic outlook on the nominal GDP growth. However, the government's economic outlook has changed in recent times. According to Ashiya (2007), the year-ahead real GDP forecasts were excessively optimistic in the 1990's; the forecast accuracy has improved after the 2000s and is equivalent to that of professional forecasters (Iizuka, 2014). To summarize, the Japanese government's inflation forecasts have not improved despite improvements in the real GDP growth forecasts. In this paper, we examine the reasons for this prediction error based on the following three aspects. First, we evaluate GDP and inflation forecasting by using directional analysis, simultaneously, as in Sinclair et al., (2010). Second, we examine considering the difference between the GDP deflator forecast and the CPI forecast. Third, our analysis involves the reliability of the Phillips curve at low inflation rates (eg, Faust and Wright, 2013).

SSA1   New findings and theoretical developments

Date: Monday June 30, 10:00-11:00am
Venue: Van der Vorm
Chair: Hossein Hassani (Bournemouth University)

ID327 Mansi Ghodsi (Bournemouth University) - *SSA weighted linear recurrent formula forecasting approach*

E-mail: mghodsi@bournemouth.ac.uk
Abstract: The Singular Spectrum Analysis (SSA) technique has been used widely for time series analysing and forecasting. A new SSA forecasting approach, based on weighted linear recurrent formulae, is proposed. The results are compared with those obtained using the simple linear recurrent formulae. Simulation studies and real data analysis confirm that the proposed technique provides more accurate forecasts than the Basic SSA.

ID233 Donya Rahmani (Bournemouth University) - A New Singular Spectrum Analysis Confidence IntervalID233 Donya Rahmani, co-authors: Hossein Hassani, Bournemouth University; Mansi Ghodsi, Bournemouth University

E-mail: drahmani@bournemouth.ac.uk
Abstract: Sensitivity of different forecasting methods can be evaluated by means of confidence intervals at a predetermined level of specificity. In relation to evaluating the accuracy of forecasts, a smaller confidence interval demonstrates less variation and better forecasting stability. Here, we propose a novel method for constructing confidence intervals based on estimating new coefficients for the Linear Recurrent Formula. The results indicate that the coverage provided by the proposed method is more reliable compared with the widely used approaches that were proposed along with Basic Singular Spectrum Analysis. We conduct simulation studies to compare the relative performance of the new intervals with the existing methods. Our simulation results also confirm that the newly proposed intervals outperform the current methods regarding to different time series.

ID231 Nader Alharbi (Bournemouth University) - *A New Signal Extraction Method for Singular Spectrum Analysis*, co-authors: Hossein Hassani, Bournemouth University; Mansi Ghodsi, Bournemouth University

E-mail: nalharbi@bournemouth.ac.uk
Abstract: Structure matrices play an important role in signal processing and time series analysis. A common occurring structure is the Hankel form which transfers one dimensional series to multi-dimensional series. The empirical distribution of the eigenvalues of a scaled Hankel matrix is considered. This yields several important properties with broad application, particularly for selecting the optimal value of the number of eigenvalues with respect to the concept of separability between signal and noise components in singular spectrum analysis. The distribution of the eigenvalues and its related forms is proposed as a new approach for extracting the signal component from a noisy time series. The output from this research is of importance to the field of time series analysis where noise reduction and filtering play a pivotal role in determining the accuracy of forecasts.

SSA2   Multivariate SSA

Date: Monday June 30, 3:00-4:00pm
Venue: Van der Vorm
Chair: Hossein Hassani (Bournemouth University)

ID241 Johannes Coremans (Bournemouth University) - *Using Multivariate Singular Spectrum Analysis for testing causality between short- and long term inflation forecasting*, co-authors: Hossein Hassani, Bournemouth University; Saeed Heravi, Cardiff University; Joshy Easaw, Swansea University
E-mail: jcoremans@bournemouth.ac.uk
Abstract: This paper evaluates the professional forecasts, those made by financial and non-financial forecasters and the aggregate between them, by comparing their results to academic forecasts. The US quarterly inflation rate and the professional forecasts are considered for the period 1981 third quarter - 2012 final quarter. One year ahead forecasting has been done to measure short term performance and ten year ahead forecasting has been done to measure the long term performance. All forecasts of the US inflation rate has been done for a period of 8 years, 2005 until 2012. This paper examines whether academic forecasts, e.g. based upon singular spectrum analysis, outperforms the professional forecasts. The random walk, singular spectrum analysis, Holt-Winters and ARIMA models are used to evaluate the accuracy of the professional forecasters' performance as predictor. For short term inflation forecasting the professional forecasters' (non-financial, financial and the aggregate) prove to be most accurate, however for long term inflation forecasting Univariate Singular Spectrum Analysis (SSA) proves to be most accurate. Multivariate SSA (MSSA) has been used as a method to test for causality between the short and long term forecast and amongst the professional forecasters' expectations. The results show that the long term aggregate forecasts are based on information from the aggregate short term forecasts and from the actual inflation figures. Furthermore, financial forecasters' use the short term non-financial forecasts in their expectations and the non-financial forecasters' use the short term financial forecasts in their long term expectations. Also the MSSA outcomes show causality between the short and long term forecasts of the non-financial forecasters. For the financial inflation forecasts, there is no causality between the short and long term financial forecasts as the multivariate forecasts underperformed the univariate forecasts. The non-financial forecasters do use their long term expectations in their short term expectations as the multivariate forecasts outperformed the univariate forecasts.

ID236 Xu Huang (Bournemouth University) - *Causality Analyses between Crime Rates and Alcohol Prices*, co-authors: Hossein Hassani, Bournemouth University; Mansi Ghodsi, Bournemouth University
E-mail: Xu.Huang@bournemouth.ac.uk
Abstract: The relationships between alcohol prices and crime rates have been proposed and evaluated by many scholars with research focusing on economic indicators and crime attracting increased attention in the modern world. In this paper, we seek to prove a causality relationship between alcohol prices and crime rates by exploiting data for alcohol prices and assault numbers in Cardiff. We also introduce a causality test based on the singular spectrum analysis technique. One advantage of the novel method based on SSA technology is that the series length of two variables being tested can be different as the multivariate SSA approach for testing causality is not bound by limitations relating to the lengths of two variables. In this research, the assault number of Cardiff is the daily data from 1st January of 2005 to 31st December of 2012, whilst the alcohol prices

data concludes the monthly on-trade and off-trade alcohol prices from January of 2005 to December of 2012. In order to enable application of the Granger Causality test, the data is reconstructed such that both variables are of identical size. A comparison between the proposed MSSA based causality test and Grange Causality confirms the former outperforms the latter and provides more efficient and accurate results.

ID323 Hossein Hassani (Bournemouth University) - *Multivariate singular spectrum analysis for forecasting revisions to real-time data*, co-authors: Kerry Patterson, University of Reading; Saeed Heravi, Cardiff University

E-mail: hhassani@bournemouth.ac.uk

Abstract: Real-time data on national accounts statistics typically undergo an extensive revision process, leading to multiple vintages on the same generic variable. The time between the publication of the initial and final data is a lengthy one and raises the question of how to model and forecast the final vintage of data. To solve this problem, we develop the non-parametric method of multivariate singular spectrum analysis (MSSA) for multi-vintage data. MSSA is much more flexible than the standard methods of modelling that involve at least one of the restrictive assumptions of linearity, normality and stationarity. The benefits are illustrated with data on the UK index of industrial production: neither the preliminary vintages nor the competing models are as accurate as the forecasts using MSSA.

SSA3   SSA and its applications I

Date: Tuesday July 1, 10:00-11:00am
Venue: Van der Vorm
Chair: Hossein Hassani (Bournemouth University)

ID266 Zara Ghodsi (Bournemouth University) - *Gene expression signal extraction using singular spectrum analysis: A minimum variance based approach*, co-author: Hossein Hassani, Bournemouth University
E-mail: zghodsi@bournemouth.ac.uk
Abstract: Despite the fact that several models have been proposed to describe the Drosophila segmentation's gene gradient, due to its association with huge sources of error, each can only partially explain its characteristics. In this paper the singular spectrum analysis technique based on minimum variance is introduced for filtering the gene expression series and extracting the signal. The results with strong evidence indicate that the proposed new technique is able to remove noise more effectively and can be considered as a promising method for filtering gene expression measurements for other applications.

ID71 Emmanuel Sirimal Silva (Bournemouth University) - *Forecasting U.S. Tourist Arrivals using Singular Spectrum Analysis*, co-authors: Hossein Hassani, Bournemouth University; Allan Webster, Bournemouth University
E-mail: esilva@bournemouth.ac.uk
Abstract: This paper introduces Singular Spectrum Analysis (SSA) for tourism demand forecasting via an application into total monthly U.S. Tourist arrivals from 1996-2012. The global tourism industry is today, a key driver of foreign exchange inflows to an economy. We analyse and test the US tourist arrivals data for normality and stationarity initially as both parametric and nonparametric forecasting models are evaluated here. We then forecast and compare the results from SSA with those from ARIMA, Exponential Smoothing (ETS) and Neural Networks (NN). We find statistically significant evidence proving that the SSA model outperforms the optimal ARIMA, ETS and NN models at forecasting total U.S. Tourist arrivals. The study also finds SSA outperforming ARIMA at forecasting U.S. Tourist arrivals by country of origin with statistically significant results. In the process, we find strong evidence to justify the discontinuation of employing ARIMA, ETS and a feedforward NN model with one hidden layer as a forecasting technique for U.S. Tourist arrivals in the future, and introduce SSA as its highly lucrative replacement.

ID345 Christina Beneki (TEI of Ionian Islands) - *Forecasting Exchange Rates with Singular Spectrum Analysis*, co-author: Masoud Yarmohammadi, Payame Noor University
E-mail: benekic@teiion.gr
Abstract: Over the years both researchers and academics have endeavoured to develop the best forecasting model to predict the higly unpredictable foreign exchange market. In the process, both parametric and nonparametric techniques have been evaluated. It is not the intention of the paper to evaluate the forecasting performance of all such models. The main objective of this paper is, to evaluate different SSA variations for forecasting exchange rates in the United Kingdom, European Union, and China.

SSA4   SSA and its applications II

Date: Tuesday July 1, 3:00-4:00pm
Venue: Van der Vorm
Chair: Hossein Hassani (Bournemouth University)

ID106 Keila Mara Cassiano (UFF) - *ARIMA model, Neural Networks and SSA in the short term electric load forecast*, Co-authors: Moises Lima de Menezes, UFF; Luiz Albino Teixeira Junior, UNILA; Jose Francisco Pessanha, UERJ; Rafael Morais de Souza, UFMG; Reinaldo Souza, PUC-Rio
E-mail: keilamath@hotmail.com

Abstract: The ARIMA and Artificial Neuron Networks (ANN) methods are very useful techniques in the electricity load forecast. The singular spectrum analysis (SSA) method can decompose a time series in k components plus a noise time series. In this paper it is proposed a hybrid method to load forecasting. First, it is applied SSA in the hourly electricity load time series. Next, the forecast of each component is obtained by the combination of forecasts from ARIMA and ANN methods. Finally, the forecasts for the components are added up together in order to obtain the forecast. To illustrate, an electricity load time series available at the web page of Electric Reliability Council of Texas is used.

ID340 Moies Lima de Menezes (UFF) - *PAR(p) and Singular Spectrum Analysis Approach in the Modeling and Scenarios Generation*, Co-authors: Reinaldo Castro Souza, PUC-Rio; Jose Francisco Pessanha, UERJ
E-mail: moises_lima@msn.com

Abstract: Due to the predominance of hydraulic sources in the Brazilian electrical system, there is a large uncertainty in future energy supply. To deal with hydrologic uncertainty, the optimal operation policy of the Brazilian electric system is the result of a sophisticated stochastic optimization where are considered a large set of synthetic series (scenarios) of Affluent Natural Energy (ENA). Traditionally, synthetic ENA series have been generated by periodic autoregressive models PAR (p). Recently, the advent of wind energy and its growth of participation in Brazilian electrical system indicate to the need for methods to generate synthetic series of wind speed. Thus, this paper proposes a methodology for generating synthetic series based on the combined use of PAR (p) models and the Singular Spectrum Analysis (SSA). The proposed methodology is general and can be used to generate synthetic series of ENA and wind speed. SSA is a recent methodology in time series. Through SSA it can extract trends or seasonality and smoothing by removing the series of noisy components. SSA has been successfully applied in various fields of knowledge as in Hydrology and Economics. Multi-channel Singular Spectrum Analysis (MSSA) is a natural extension of the SSA when applied to multiple series simultaneously. The proposed methodology was applied to the ENA series of four electric subsystems (Northeast, North, Southeast / Midwest and South) and compared to the PAR (p) existing model. Additionally, the proposed methodology was applied to the generation of synthetic series of wind speed at two sites located in the Brazilian Northeast. The good results achieved demonstrate that the proposed methodology can be used to generate synthetic series of ENA and wind energy considered in stochastic optimization models that assist planning the operation of the Brazilian electric energy system.

ID332 Keila Mara Cassiano (UFF) - *Combination of SSA-Singular Spectrum Analysis of Time Series with Density Based Spatial Clustering*, co-authors: José Francisco Pessenha, UERJ; Reinaldo Castro, PUC-Rio

E-mail: keilamath@hotmail.com

Abstract: This work proposes using DBSCAN (Density Based Spatial Clustering of Applications with Noise) to separate the noise components of eigentriples in the grouping stage of the Singular Spectrum Analysis (SSA) of Time Series. DBSCAN is a modern (revised in 2013) and expert method at identify noise through regions of lower density. This is a relevant proposal, since the hierarchical clustering method was the last innovation in noise separation in SSA approach, implemented on package R-SSA. However, is repeated in the literature that the hierarquical clustering method is very sensitive to noise, is unable to separate it correctly, should not be used in clusters with varying densities and neither works well in clustering time series of different trends. Unlike the methods of density-based clustering which are effective in separating the noise from the data and dedicated to work well on data from different densities The hierarchical method was proposed in 1955 and since this year had been developed at least 120 new clustering methods. So, it is important bring to the SSA approach the progress achieved in the area of clustering in these 60 years. Our studies were initiated in order to propose a expert in noise separation non-hierarchical modern clustering method that has never been applied before on studies in the area of SSA in time series. This work shows better efficiency of DBSCAN over the others methods already used in this stage of SSA, because it allows considerable reduction of noise and provides better forecasting. The result is supported by experimental evaluations realized for simulated series of Box-Jenkins models. The proposed combination of methodologies also was applied to forecasting of real series.

SSA5   SSA
Date: Wednesday July 2, 10:00-11:00am
Venue: Van der Vorm
Chair: Meri Andani Rosmalawati (University of Padjadjaran)

ID79   Nur Azizah Komara Rifai (Universitas Padjadjaran) - *Modeling Long Memory Time Series by Singular Spectrum Analysis*, Co-author: Gumgum Darmawan, Universitas Padjadjaran
E-mail: dunk_zizah_1211@yahoo.com

Abstract: Singular Spectrum Analysis (SSA) has been used as a powerful technique in time series analysis. It has been developed and applied to many practical problems. In this paper, we use SSA for modeling long memory time series data of Handymax (Handysize vessel) price. Comparing with ARFIMA (Auto Regressive Fractionally Integrated Moving Average) model that the SSA (Singular Spectrum Analysis) yields a significantly higher accuracy in the prediction.

ID119 Helena Viljoen (Stellenbosch University) - *A comparison of Stepwise Common Singular Spectrum Analysis and Multi-channel Singular Spectrum Analysis*, co-authors: Sarel Steel, Stellenbosch University; Daan Nel, Stellenbosch University
E-mail: lienki@sun.ac.za

Abstract: Multi-channel SSA (MSSA) is an extension of singular spectrum analysis (SSA) to handle more than one time series simultaneously (Golyandina et al, 2003). Common Singular Spectrum Analysis (Viljoen and Nel, 2010) is a method to extend SSA to two or more time series which share a common manifold (R-flat) by using the common principal component (CPC) approach of Flury (1988). Rather than using the FG-algorithm of Flury, the stepwise CPC method of Trendafilov (2010) is used to compute the principal base vectors spanning the common R-flat. In a simulation study, different signal structures, defined in terms of trend, period, amplitude and phase were investigated. In broad terms we find that neither Multi-channel SSA nor Stepwise Common SSA is best in all cases. As an illustration a practical example is discussed. The resulting matrices of orthogonal base vectors from MSSA and CSSA are also computed and compared to assist in understanding some differences between CSSA and MSSA fitting and forecasting.

ID224   Meri Andani Rosmalawati (University of Padjadjaran) - *Comparison of Parameters Estimation Based on Forecasting Accuracy in Singular Spectrum Analysis (SSA)*, Co-authors: Iman Bimantara Mumin, University of Padjadjaran; Gumgum Darmawan, University of Padjadjaran;Toni Toharudin, University of Padjadjaran
E-mail: andaniros@gmail.com

Abstract: Singular Spectrum Analysis (SSA) has been used as a powerful technique on Time Series Analysis. In this paper, we use SSA to forecast Crude Palm Oil (CPO) price in Rotterdam's Physical Market data and MDEX (Malaysia Derivatives Exchange)data by means of parameter approximation, both reccurent and vector. Based on comparison of parameters estimation of those methods (recurrent and vector), we can conclude that the recurrent method has better level of accuracy.

TSM1   Regularization

Date: Monday June 30, 10:00-11:00am
Chair: Patrick Groenen (Erasmus University Rotterdam)

ID35 Peter Exterkate (CREATES, Aarhus University) - *Distribution Forecasting in Nonlinear Models with Stochastic Volatility*

E-mail: exterkate@creates.au.dk

Abstract: Kernel ridge regression is a technique to perform ridge regression with a potentially infinite number of nonlinear transformations of the independent variables as regressors. This makes it a powerful forecasting tool, which is applicable in many different contexts. However, it is usually applied only to iid observations. This paper introduces a variant of kernel ridge regression for time series with stochastic volatility. The conditional mean and volatility are both modelled as nonlinear functions of observed variables. We set up the estimation problem in a Bayesian manner and derive a Gibbs sampler to obtain draws from the predictive distribution. A simulation study and an application to forecasting the distribution of returns on the S&P500 index are presented, and we find that our method outperforms most popular GARCH variants in terms of one-day-ahead predictive ability. Notably, most of this improvement comes from a more adequate approximation to the tails of the distribution.

ID354 Laurent Callot (VU University Amsterdam) - *Forecasting Of Large Realized Covariance Matrices And Portfolio Choice*, co-authors: Anders Kock, Aarhus University; Marcelo Meideros, PUC Rio

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Abstract: This paper deals with modeling and forecasting vast realized daily covariance matrices using vector autoregressive models. The number of equations grows quadratically with the number of stocks considered so that the number of parameters in the VAR model grows as the fourth power of the number of stocks considered. To overcome the curse of dimensionality we use estimators from the LASSO class. We assess the performances of these forecasts both in terms of forecast error and by constructing portfolios minimizing the expected risk.

ID371 Katrijn Van Deun (KU Leuven) - *Sparse Principal Covariates Regression for high-dimensional data*

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Abstract: Prediction in a context of high-dimensional data, this is data with many more covariates than observations, is an ill-posed problem. Popular solutions are the introduction of penalties that impose sparseness (e.g., the elastic net in regression) and the use of dimension reduction methods to reduce the covariates to a few components (e.g., principal covariates regression which simultaneously optimizes the reduction of the covariates to a few components and the prediction of the outcome by these components). From an interpretational point of view it is attractive to reduce the covariate space to a few meaningful underlying components. However, interpretation of the components obtained for high-dimensional data is daunting as the components are based on a linear combination of a large number of variables. To account for this interpretational issue, we propose a sparse principal covariates regression approach that imposes sparseness on the number of variables that make up the components. We will also propose an efficient procedure to estimate the sparse principal covariates regression model and we will illustrate with gene expression data used to predict the antibody titers, of subjects vaccinated against influenza, by thousands of genes.

TSM2   Forecasting nonstationary economic data

Date: Monday June 30, 10:00-11:00am
Venue: Ruys
Chair: Rebecca Killick (Lancaster University)

ID50 Jennifer Castle (Oxford University) - *Robust Approaches to Forecasting*,
co-authors: Michael Clements, University of Reading; David Hendry, Oxford University
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Abstract: We investigate alternative robust approaches to forecasting, using a new class of robust devices, contrasted with equilibrium-correction models. Their forecasting properties are derived facing a range of likely empirical problems at the forecast origin, including measurement errors, impulses, omitted variables, unanticipated location shifts and incorrectly included variables that experience a shift. We derive the resulting forecast biases and error variances, and indicate when the methods are likely to perform well. The robust methods are applied to forecasting US GDP using autoregressive models, and also to autoregressive models with factors extracted from a large dataset of macroeconomic variables. We consider forecasting performance over the Great Recession, and over the earlier more quiescent period.

ID61 Alvaro Faria (The Open University) - *Dynamic Bayesian smooth transition auto-regressive models for non-linear non-stationary processes*, co-author:
Alexandre Santos, The Open University
E-mail: alvaro.faria@open.ac.uk
Abstract: A class of Dynamic Bayesian Smooth Transition Auto-Regressive (DBSTAR) models is proposed for non-linear time series processes as an alternative to both the Smooth Transition Auto-regressive (STAR) model of Chan and Tong (1986) and the computational Bayesian STAR (CBSTAR) model of Lopes and Salazar (2005). Unlike the STAR and the CBSTAR models, the DBSTAR models are parsimonious sequential models suitable for inherently non-stationary time series processes. For being analytic, they are computationally fast and can thus be applied to real-time data. An application to the Canadian lynx series showed improved forecasting performance over STAR and CBSTAR models. Fast and accurate forecasts were also obtained for a series of hourly electricity loading in Brazil.

ID115   Rebecca Killick (Lancaster University) - *Forecasting locally stationary time series*, Co-authors: Guy Nason, University of Bristonl; Marina Knight, University of York; Idris Eckley, Lancaster University
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Abstract: Within the energy sector forecasting is an important statistical tool. Each day many forecasts are made across a variety of time scales, such as production of renewables, consumer demand and trader pricing. Traditional statistical techniques assume stationarity of the past in order to produce accurate forecasts. For data arising from the energy sector this stationarity assumption is often violated. This talk will highlight potential issues and propose a new estimator, the local partial autocorrelation function, which will aid us in forecasting nonstationary data. We illustrate the new estimator and forecasting method and show improved forecasting performance using this new technique.

TSM3   Seasonal adjustment I
Date: Monday June 30, 10:00-11:00am
Venue: Plate
Chair: Keith Phillips

ID161   Michel Ferland (Statistics Canada) - *On the use of forecasts when forcing annual totals on seasonally adjusted data*, Co-authors: Margaret Wu, Statistics Canada; Susie Fortier, Statistics Canada
E-mail: Michel.Ferland@statcan.gc.ca
Abstract: The use of forecasts in seasonal adjustment softwares such as X-12-ARIMA or the SAS X12 procedure is well known to minimize revisions. In practice, seasonally adjusted series are also often benchmarked to the raw (unadjusted) series annual totals to maintain consistency between both sources. This step is done through an X-12 option called FORCE. Under this option, the use of forecasts in the seasonal adjustment process influences the benchmark for the last incomplete year of data; if forecasts are used and cover the rest of the incomplete year, they contribute to an explicit benchmark, and if not, the benchmark is implicit and relies only on assumptions of the specific benchmarking method (e.g. modified Denton in PROC X12). Once the last year of data becomes complete as more data is obtained, there is a switch from the implicit to the explicit benchmark when forecasts are not used. The impact of this behaviour on revisions to the "forced" seasonally adjusted series was studied empirically using data from various sources. Month-to-month revisions in the first twelve months following the initial or concurrent estimate and revisions to a "final" estimate were both considered.

ID140 Michael Sverchkov (Bureau of Labor Statistics) - *Estimation of Mean Squared Error of X-11-ARIMA and Other Estimators Of Time Series Components*
E-mail: Sverchkov.Michael@bls.gov
Abstract: This paper considers the old but very important problem of how to estimate the mean squared error (MSE) of seasonally adjusted and trend estimators produced by X-11-ARIMA or other decomposition methods. The estimators of trend and seasonally adjusted components, and the MSE estimators are obtained by defining the unknown target components to be the hypothetical X-11 estimates in the absence of sampling errors and when the series is sufficiently long to allow the use of the symmetric filters embedded in the program. This definition of the component series conforms to the classical definition of the target parameters in design-based survey sampling theory, so that users should find it comfortable to adjust to this definition.

ID62 Keith Phillips (Federal Reserve Bank of Dallas) - *Spurious Seasonal Patterns and Other Distortions in the BLS Local Area Unemployment Statistics*, co-author: Jianguo Wang, Federal Reserve Bank of Dallas
E-mail: keith.r.phillips@dal.frb.org
Abstract: U.S. state level unemployment statistics are some of the most important and widely used data for local analysts and public officials to gauge the health of state economies. We find statistically significant seasonal patterns in the state level seasonally adjusted Local Area Unemployment Statistics (LAUS) released by the U.S. Bureau of Labor Statistics (BLS). We find that the pro-rata factors used in the benchmarking process can invoke spurious seasonal patterns in this data. We also find that the Henderson 13 filter used by the BLS to smooth the seasonally adjusted data may reduce monthly volatility too much in the sense that the aggregated state data is much smoother than the independently estimated national data and often moves in different directions. To reduce these problems, we suggest that the BLS use seasonally adjusted data when benchmarking regions to national totals.

TSM4   Advanced exponential smoothing methods

Date: Monday June 30, 11:25am-12:45pm
Venue: Ruys
Chair: Hanife Taylan (Dokuz Eylül University)

ID108 Keith Ord (Georgetown University) - *Exponential Smoothing: More than just a special case*, co-author: Adrian Beaumont, University of Melbourne
E-mail: ordk@georgetown.edu
Abstract: The tired mantra "Exponential smoothing is a special case of ARIMA" is still heard from practitioners and in the halls of academe, despite clear evidence to the contrary. We explore exponential smoothing within the framework of state-space models and examine the similarities, overlaps and differences compared to the ARIMA approach. Adherents to one approach may benefit from insights provided by the other and, hopefully, this encompassing of ideas will lead to the development of even better forecasting software.

ID141 Blyth Archibald (Dalhousie University) - *A Single Error Structural Model Equivalent to Harvey's Basic Structural Model*
E-mail: Blyth.Archibald@Dal.Ca
Abstract: Harvey's Basic Structural Model (BSM) [1989] uses four innovation/error processes to describe a time series with adaptive level, trend and seasonal factors. We develop structural model with a single error (SE) that is equivalent. We take regular and seasonal differences of each model to obtain stationary processes: a Moving Average for the Single Error structural model (SE-MA), a similar four dimensional "Multiple Error Moving Average" (ME-MA) for the BSM. For each, differenced series, we define the "forecast state" as the expected value of the forecast for the present and next m+1 periods (m is defined as the number of periods in the seasonal cycle). The Kalman filter is used to decompose the series, calculate the errors and likelihood for each model. The steady state solution for each model provides equations to determine the parameters for the SE-MA that produce results in the steady state that are the same as ME-MA. We then show that if these parameters are used for the SE-MA, we obtain the same forecasts, errors, Kalman gains and likelihood as the ME-MA. The covariance of the "forecast state" — the mean of the forecasts differ. However, the covariance of the forecasts are the same. A linear transform gives us the forecasts of the original series and the forecast covariance for both models. They are the same. A linear transform of the forecasts for the SE model gives us a single error Holt-Winters' type structural model that is equivalent to the BSM. From it, we obtain the "smoothing parameters" that correspond to the variance of the innovations in the BSM.

ID150   Ivan Svetunkov (Lancaster University) - *Complex Exponential Smoothing*, Co-author: Nikolaos Kourentzes
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Abstract: Exponential smoothing has been one of the most popular forecasting methods for business and industry. Its simplicity and transparency have made it very attractive. Nonetheless, modelling trends has been met with mixed success, resulting in the development of damped trend models. A new exponential smoothing framework that uses complex variables is proposed, the "Complex exponential smoothing" (CES). CES distributes weights between observations either exponentially or harmonically and has an underlying variety of ARMA models with order depending on the parameters values.

This allows CES to model and forecast effectively both trended and level time series. The proposed method is compared with Simple Exponential Smoothing (SES), Holt's method and several other forecasting methods. It is shown that CES is at least as accurate as SES and is usually more accurate than Holt's method, thus flexibly modelling both level or trend series.

ID285 Hanife Taylan (Dokuz Eylül University) - *Modified Exponential Smoothing As An Adaptive Exponential Smoothing Method*, co-author: Guckan Yapar, Dokuz Eylul University
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Abstract: The main purpose of adaptive exponential smoothing methods is to improve the forecast accuracy by changing value of smoothing parameter over time in a controlled manner as the characteristics of the time series change. However, these methods have tended to produce unstable forecasts and have performed poorly in empirical studies. In this study, we will propose an alternative smoothing method. The modification is very simple but results are surprisingly great since it gives more weight to recent observations and less weight to old observations at the same smoothing value used for exponential smoothing method. Furthermore optimum smoothing value and initial value will be obtained simultaneously and this modification will react much faster as the characteristics of the time series change.

TSM5   Trends and smoothing

Date: Monday June 30, 3:00-4:00pm
Chair: Eliud Silva (Universidad Anahuac, México Norte)

ID7 Jiawen Xu (Shanghai University of Finance and Economics) – *Forecasting in the presence of in and out of sample breaks*, co-author: Jiawen Xu, Shanghai University
E-mail: xu.jiawen@mail.shufe.edu.cn
Abstract: We present a frequentist-based approach to forecast time series in the presence of in-sample and out-of-sample breaks in the parameters of the forecasting model. We first model the parameters as following a random level shift process, with the occurrence of a shift governed by a Bernoulli process. In order to have a structure so that changes in the parameters be forecastable, we introduce two modifications. The first models the probability of shifts according to some covariates that can be forecasted. The second incorporates a built-in mean reversion mechanism to the time path of the parameters. Similar modifications can also be made to model changes in the variance of the error process. Our full model can be cast into a non-linear non-Gaussian state space framework. To estimate it, we use particle filtering and a Monte Carlo expectation maximization algorithm. Simulation results show that the algorithm delivers accurate in-sample estimates, in particular the filtered estimates of the time path of the parameters follow closely their true variations. We provide a number of empirical applications and compare the forecasting performance of our approach with a variety of alternative methods. These show that substantial gains in forecasting accuracy are obtained.

ID214 Seppo Pitkanen (Lappeenranta University of Technology) - *Traps of trend extrapolation*
E-mail: spnen@sci.fi
Abstract: Trend extrapolation is typically a tool of long-term forecasting. However, if a trend exists, its estimation is also needed in shorter-range projections (decomposition, exponential smoothing, Box-Jenkins, etc.). Here we deal with some problems that a forecaster can meat in trend estimation and/or interpretation: a) Recognizing possible transition points b) Problems of exponential or saturating growth c) Changes in background system producing the trend d) Recognizing impossible developments e) Contradictory longer- and shorter-range trends f) Mutually depending trends. It is obvious, that a reliable forecast cannot be obtained by staring at statistical measures of goodness of the model only. For a good trend forecast he/she must get acquainted with the history and circumstances of the phenomen at hand.

ID59 Eliud Silva (Universidad Anahuac, México Norte) - *Smoothing a time series by segments of the data range*, co-author: Victor Guerrero, ITAM
E-mail: jsilvaurrutia@hotmail.com
Abstract: We consider the problem of estimating a trend with different amounts of smoothness for segments of a time series subjected to different variability regimes. We propose using an unobserved components model to take into account the existence of at least two data segments. We first fix some desired percentages of smoothness for the trend segments and deduce the corresponding smoothing parameters involved. Once the size of each segment is chosen, the smoothing formulas here derived produce trend estimates for all segments with the desired smoothness, without discontinuities at the joints, as well as their corresponding estimated variances. We deal with the two-segment case in detail and simply extend the results to the three-segment situation. Empirical examples from demography and economics illustrate our proposal.

TSM6   Seasonal adjustment II
Date: Monday June 30, 3:00-4:00pm
Chair: Dominique Ladiray (INSEE)

ID76 Sylwia Grudkowska (National Bank of Poland) - *A Study on Seasonal Breaks*
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Abstract: The most widespread seasonal adjustment methods proved to be resistant to alterations in the seasonal component, but they do not cope well when these changes are abrupt and permanent. These sudden events, called seasonal breaks, have an adverse effect on seasonal adjustment results, as they deteriorate the quality of forecasts and cause the instability of estimates. Significant resources and knowledge needed for the manual identification of seasonal outliers make it difficult to apply these regressors to large datasets. However, the new open source tool for seasonal adjustment, called JDemetra+ automatically identifies and estimates these effects. This paper presents the outcome of an automatic identification of seasonal breaks in time series, including the improvement in quality of seasonal adjustment estimates and capabilities to interpret automatically identified outliers.

ID181 Martyna Marczak (University of Hohenheim) - *Indicator Saturation for Structural Time Series Models*, co-author: Tommaso Proietti, University of Rome Tor Vergata
E-mail: marczak@uni-hohenheim.de
Abstract: Structural change affects the estimation of economic signals, like the underlying growth rate or the seasonally adjusted series. An important issue, which has attracted a great deal of attention also in the seasonal adjustment literature, is its detection by an expert procedure. The general-to-specific approach to the detection of structural change, currently implemented in Autometrics via indicator saturation, has proven to be both practical and effective in the context of the stationary dynamic regression model. We investigate via Monte Carlo simulation the performance of the approach for detecting additive outliers, level shifts and slope changes in the analysis of nonstationary seasonal time series. The reference model is the basic structural model (BSM), featuring a local linear trend, possibly integrated of order two, stochastic seasonality and a stationary component. The model provides a very good fit to a wide range of seasonal economic time series dealing with industrial production, retail turnover and tourism flows, and it can be used for seasonal adjustment. The paper contributes to the literature by implementing impulse-indicator and step-indicator saturation and assessing the gauge and potency of the procedure as a function of the size of the disturbance variances.

ID131 Dominique Ladiray (INSEE) - *A large scale comparison of alternative seasonal adjustment methods*
E-mail: dominique.ladiray@insee.fr
Abstract: In this presentation, we compare several well-known seasonal adjustment methods: X-12-Arima, Tramo-Seats, Stamp, RegCmpnt, Baysea, Dainties, Decomp etc. First, we briefly describe each of them from both theoretical and practical point of view. In a second step, we apply each method on a very large number of economic time series, mostly European economic indicators, using their default values and compare their results. The comparison is mainly based on the statistical properties of the seasonally adjusted series.

TSM7 Bayesian methods
Date: Monday June 30, 4:30-5:30pm
Venue: Hudig
Chair: Iris Yip (Hang Seng Management College)

ID251 Jani Luoto (University of Helsinki) - *Noncausal Bayesian Vector Autoregression*, co-author: Markku Lanne, University of Helsinki and CREATES
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Abstract: We propose a Bayesian inferential procedure for the noncausal vector autoregressive (VAR) model that is capable of capturing nonlinearities and incorporating effects of missing variables. In particular, we devise a fast and reliable posterior simulator that yields the predictive distribution as a by-product. We apply the methods to postwar quarterly U.S. inflation and GDP growth series. The noncausal VAR model turns out to be superior in terms of both in-sample fit and out-of-sample forecasting performance over its conventional causal counterpart. In addition, we find GDP growth to have predictive power for the future distribution of inflation over and above the own history of inflation, but not vice versa. This may be interpreted as evidence against the new Keynesian model that implies Granger causality from inflation to GDP growth, provided GDP growth is a reasonable proxy of the marginal cost.

ID339 George Monokroussos (European Commission, Joint Research Centre) – *Nowcasting in Real Time Using Popularity Priors*
E-mail: monokroussos@gmail.com
Abstract: This paper proposes a Bayesian nowcasting approach that utilizes information coming both from large real-time data sets and from priors constructed using internet search popularity measures. Exploiting rich information sets has been shown to deliver significant gains in nowcasting contexts, whereas popularity priors can lead to better nowcasts in the face of model and data uncertainty in real time, challenges which can be particularly relevant during turning points. It is shown, for a period centered on the latest recession, that this approach has the potential to deliver particularly good real-time nowcasts of GDP growth.

ID295   Iris Yip (Hang Seng Management College) - *Bayesian estimation of infinite mixture model*, Co-author: John W. Lau, University of Western Australia
E-mail: irisyip@hsmc.edu.hk
Abstract: This paper proposes an infinite mixture model which is flexible enough to model the skewness and kurtosis of the distribution naturally. The main feature of this model is that the return innovations are not specified by a particular distribution such as normal. Estimation is performed using Markov Chain Monte Carlo method. Forecasts of volatility and value at risk can be generated from the posterior predictive distributions. The proposed methodology is illustrated using both simulated and real market data.

TSM8   Seasonality I
Date: Monday June 30, 4:30-5:30pm
Venue: Plate
Chair: Jan Jacobs (University of Groningen)

ID355   Irma Hindrayanto (De Nederlandsche Bank) - *On Trend-Cycle-Seasonal Interaction*, Co-authors: Jan Jacobs, University of Groningen; Denise Osborn, University of Manchester
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Abstract: Traditional unobserved component models assume that the trend, cycle and seasonal components of an individual time series evolve separately over time. Although this assumption has been relaxed in recent papers that focus on trend-cycle interactions, it remains at the core of all seasonal adjustment methods applied by official statistical agencies around the world. The present paper develops an unobserved components model that permits non-zero correlations between seasonal and non-seasonal shocks, hence allowing testing of the uncorrelated assumption that is traditionally imposed. Identification conditions for estimation of the parameters are discussed, while applications to observed time series illustrate the model and its implications for seasonal adjustment.

ID357 Tomas del Barrio Castro (Universitat de les Illes Balears) – *The Distribution of Unit Root Test Statistics after Seasonal Adjustment*, co-author: Denise Osborn, University of Manchester
E-mail: tomas.barrio@uib.es
Abstract: This paper argues that seasonal adjustment will generally induce noninvertible moving averages and examines the consequences for the distributions of (zero frequency) unit root test statistics for I(1) processes. The seasonal adjustment procedure analyzed is the X-11 seasonal adjustment method. Previous studies of X-11 find that seasonal adjustment has no asymptotic impact on tests under the null hypothesis of (zero frequency) integration and cointegration, but this conclusion rests on an invertibility assumption that we argue is typically invalid. As the usual unit root tests do not satisfactorily deal with noninvertible moving average components, then inferences (even asymptotically) about the presence of unit roots can be unreliable for seasonally adjusted data. We illustrate these effects analytically and through Monte Carlo simulation, for Augmented Dickey-Fuller, the Phillips-Perron, the M-type and the Variance ratio tests. Monte Carlo analysis of the large sample distributionsand finite sample size properties of these unit root tests are examined for a range of seasonal and nonseasonal I (1) processes.

ID356 Jan Jacobs (University of Groningen) - *Seasonal Adjustment in Real Time: A Comparison of X-13ARIMA-SEATS and CAMPLET*, co-authors: Barend Abeln; Jan G. De Gooijer, University of Amsterdam

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Abstract: Time series are typically seasonally adjusted before being used in economic and econometric analyses. Recently, the two methods with the largest market shares in the field, Census X-12 and Tramo-Seats, merged into X-13ARIMA-SEATS, and became the world standard. The aim of the present project is to compare a new - but at the same time old - competitor, CAMPLET, to X13ARIMA-SEATS, especially focusing on their application in real-time. The project consists of describing the properties of both methods, and formal comparisons on the basis of simulated data with different properties in terms of trend, cycle, seasonal, breaks etc., and in real-time.

TSM9   Time series methods
Date: Monday June 30, 4:30-5:30pm
Venue: Ruys
Chair: Raffaello Seri (Università degli Studi dell'Insubria)

ID156 Gael Martin (Monash University) - *Probabilistic Forecasting in Long Memory Models*, co-authors: Indee Perera, Monash University; Don Poskitt, Monash University

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Abstract: The focus of his paper is on the quantification of frequentist sampling variation in the production of probabilistic forecasts in long memory models. The ideas are developed within a specific class of such models - the fractionally integrated class - used to represent many macroeconomic and financial time series variables; aggregate output, inflation, exchange rates and stock market volatility being foremost examples. We explore a variety of ways of constructing confidence 'regions' via bootstrap methods that respect the functional nature of the quantity being bootstrapped; thereby providing different ways of visualizing the role played by estimation uncertainty in the distributional forecasting exercise. Most notably, we address the inherent inconsistency in allowing for parameter variation in the bootstrap draws whilst holding the conditioning values that define the forecast distribution fixed at the observed values. Whilst this inconsistency pertains to forecasts produced from any time series model, it is particularly stark in the long memory setting, in which the full set of observed data influences the future values assumed by the variable in question and, hence, serves to define the forecast distribution being estimated. We demonstrate that modifying the bootstrapping algorithm to cater for sampling variation in the conditioning values, in addition to the parameter estimates, produces vastly different confidence regions and, hence, conclusions regarding the future value of the random variable in question.

ID270 Wei Lin (Capital University of Economics and Business) – *Interval-valued Time Series Analysis: a MLE Approach Based on Ordinal Statistics*, co-author: Gloria Gonzalez-Rivera

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Abstract: The current regression models for interval-valued data ignore the extreme nature of the lower and upper bounds of intervals. We propose an alternative approach that considers the bounds of the interval as realizations of the max/min order statistics coming from a sample of n_t random draws from the conditional density of an underlying strictly stationary stochastic process y_t. We estimate a dynamic model for the conditional mean and conditional variance of the process y_t, which is assumed to be normally distributed, and for the conditional intensity of the discrete process n_t, which follows a negative binomial density function. Under these assumptions, together with the densities of order statistics, we obtain maximum likelihood estimates of the parameters of the model which are needed to estimate the expected bounds of the interval, and investigate the asymptotic behavior of the ML estimator via Monte Carlo simulation. We illustrate this approach by modeling low/high livestock returns, which are as difficult to predict as financial returns, even though livestock is intrinsically very different from stocks and other financial assets.

ID278 Raffaello Seri (Università degli Studi dell'Insubria) – *Asymptotic Properties of Growth Rates*, co-author: Christine Choirat, Universidad de Navarra

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Abstract: Consider a time series such that the series obtained taking the ratio of two successive values of the original one is a stationary process: this class includes also stationary time series. We introduce three growth rates, the average growth rate, the long-term growth rate and the logarithmic growth rate. Even if it is customary to suppose that these definitions are almost equivalent, we show that their behavior is very different. The behavior of the average growth rate is standard, since it is always asymptotically normal, with a variance that can be computed. We show that the average growth rate bias observed in dynamical systems holds in this case too. This implies that conclusions on the growth of a process obtained looking at this growth rate are misleading. On the other hand, the asymptotic behavior of the logarithmic growth rate (and of the long-term growth rate, that is an increasing transformation of it) deserves more attention. Its classical estimator is asymptotically normal when the ratio of successive values is stationary (and the time series itself is not), but its asymptotic distribution is non-standard when the time series is stationary. We obtain the rate of convergence of the finite-sample distribution to the asymptotic one in the form of a Berry-Esséen bound that is shown to depend on the memory of the process. Moreover, in order to evaluate the asymptotic distribution of the growth rate, we provide two methods based respectively on the empirical cdf and on kernel non-parametric density estimation and we obtain their rate of convergence. Implications for unit-root testing are considered.

TSM10 Seasonality II
Date: Tuesday July 1, 10:00-11:00am
Venue: Plate
Chair: Robert Kunst (Institute for Advanced Studies)

ID338 Katja Drechsel (Halle Institute for Economic Research) - *Regional GDP flash estimates: Do seasonal adjustment procedures matter?*, Co-author: Birgit Schultz, Halle Institute for Economic Research
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Abstract: We analyze the forecast performance of quarterly GDP flash estimates for East Germany. Policy makers in regional institutions are interested in a frequently and timely assessment and projection of economic growth and in particular on regional GDP forecasts. However, data on regional GDP is only available at annual frequency with substantial delay for the German states from the German statistical office. The Halle Institute for Economic Research provides such a unique quarterly GDP time-series for East Germany. Our quarterly GDP forecasts are then based on individual indicator forecasts and pooled forecasts. Besides quarterly regional indicators we use national and international data sources as well. Hence, we circumvent at the one hand the huge delay in data publication and poor regional data availability and at the other hand it allows us to evaluate whether regional forecasts can be improved more by regional or (inter)national indicators. Furthermore this paper analyzes whether the forecast performance changes when different seasonal adjustment procedures (X12 and Berliner Verfahren - BV4) are applied to GDP and indicators. Both adjustment methods incorporate outliers different, which is particular interesting for the adjustment of values at the end of the sample. The analysis shows that the forecast errors are in general lower for BV4 adjusted series. In addition only few regional indicators can beat pooled forecasts in the BV4 framework. National and international indicators do matter for regional GDP forecasts as well.

ID248 Lucia Andreozzi (Universidad Nacional de Rosario) - *Time series models for different seasonal patterns*, Co-authors: Maria Teresa Blacona, Universidad Nacional de Rosario; Luciana Magnano, Universidad Nacional de Rosario
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Abstract: In this paper Innovations Space State Models (SSM) are used to fit series with: 1) a single seasonal period and 2) multiple seasonal periods. Sales data of 1) axles and 2) suspensions of a metallurgical company from Alvear (Santa Fe, Argentina) are analyzed as series with a single seasonal pattern. To analyze series with complex seasonal patterns, the series of a) daily vehicles passing through the toll booth on the Rosario- Buenos Aires (Argentina) highway and b) Las Rosas (Santa Fe, Argentina) daily average gas consumption per customer measured in m3. The main purpose of these comparisons is to obtain predicted values with an acceptable error and a controllable level of uncertainty. Another reason for these comparisons is that Argentinean series show more variability than those with more stable development countries. In series with a single seasonal pattern, ETS models have a good post-sample forecasting performance. The out-of-sample average forecast error five-step-ahead are 9.4% and 6.9%, for axles and suspensions, respectively, with a controllable level of uncertainty. BATS (Exponential Smoothing State Space model with Box-Cox transformation, ARMA errors, Trend and Seasonal Components) and TBATS (Trigonometric Exponential Smoothing State Space model with Box-Cox transformation, ARMA errors, Trend and

Seasonal Components) are introduced to forecast complex seasonal time series. The results show that both types of models are suitable to describe and predict the time series of daily vehicles. The TBATS model has some advantages over the BATS model such as: i) better goodness of fit (lower AIC), ii) lower out-sample forecast percentage for different horizons (measured by MAPE); reduction in computation time to estimate the model, given the smaller number of seed values. However, for the gas demand data, the performance of the proposed models is not as good, the BATS model does not show a good fit, and although the TBATS model fits the data well, it provides forecasts with more error than a MEE with Spline. A possible explanation for the lower quality forecasts of the TBATS, is that in this application TBATS models do not include explanatory variables that are included in the SSM, and it is known that climatic variables have much influence on utilities demand series. However, given the simplicity these models, they cannot be completely discarded.

ID133 Robert Kunst (Institute for Advanced Studies) - *Forecasting seasonal data and nonparametric unit-root tests*

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Abstract: Nonparametric unit-root tests are a useful addendum to the toolbox of time-series analysis. They tend to trade off power for enhanced robustness features. We consider a variant of the RURS (seasonal range unit roots) test statistic, a variant of the level-crossings count adapted to classes of seasonal patterns, and a combined test. These tests exploit two main characteristics of seasonal unit-root models, the range expansion typical of integrated processes and the low frequency of changes among main seasonal shapes. In this contribution, the consequences of test-based decisions for predictions of seasonal time series are explored. It is of particular interest whether power gains relative to parametric tests are reflected in improved forecast accuracy. Apart from generating processes with seasonal unit roots and with deterministic seasonality, also processes with seasonal time deformation are considered.

TSM11 Hierarchical time series
Date: Tuesday July 1, 11:25am-12:45pm
Venue: Hudig
Chair: George Athanasopoulos (Monash University)

ID183 George Athanasopoulos (Monash University) - *Forecasting Hierarchical Time Series*, co-authors: Rob Hyndman, Monash University; Nikolaos Kourentzes, Lancaster University; Fotios Petropoulos, Lancaster University
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Abstract: Hyndman, Ahmed, Athanasopoulos and Shang (2011) proposed the optimal combination approach for forecasting hierarchical time series. This approach involves forecasting each series in the hierarchy independently and then revising these forecasts so that they add up across the hierarchy. In particular, under a simplifying assumption about the in-sample forecasts errors a regression model is estimated using ordinary least squares. This returns a set of weights that are used to revise the independent forecasts so that they add up. The revised forecasts are unbiased and have minimum variance amongst all combination forecasts. In this paper we relax the simplifying assumption about the in-sample forecasts errors, and propose two alternative estimators for the in-sample forecast error variance-covariance matrix. We refer to these as the standard deviation scaling and independent scaling estimators. We use the generalised least squares estimator with gains in efficiency that result to more accurate revised forecasts for forecasting hierarchical time series. Furthermore, the independent scaling estimator we propose is a natural candidate for taking this framework in a setting where we forecast an individual time series using what we refer to as temporal hierarchies. Temporal hierarchies comprise the observations of the highest frequency of a time series at the bottom level (say monthly), observations of the lowest frequency at the top level (annual) and in-between frequencies in the intermediate levels of the hierarchy (say, bimonthly, quarterly, semi-annual). By forecasting each component individually and reconciling these using the independent scaling estimator for the GLS framework we observe significant gains in forecast accuracy.

ID179   Rob Hyndman (Monash University) - *Fast computation of reconciled forecasts in hierarchical time series*, Co-author: Alan Lee, University of Auckland
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Abstract: Time series can often be naturally disaggregated in a hierarchical structure. For example, a manufacturing company can disaggregate total demand for their products by country of sale, retail outlet, product type, package size, and so on. As a result, there can be tens of thousands of individual time series to forecast at the most disaggregated level, plus additional series to forecast at higher levels of aggregation. The most disaggregated series often have a high degree of volatility (and are therefore hard to forecast), while the most aggregated time series is usually smooth and less noisy (and is therefore easier to forecast). Consequently, forecasting only the most disaggregated series and summing the results will often give poor results at the higher levels of aggregation. On the other hand, if all the series at all levels of aggregation are forecast independently, the forecasts will not add up consistently across the hierarchy. Therefore, it is necessary to reconcile the forecasts to ensure that the forecasts of the disaggregated series add up to the forecasts of the aggregated series. Hyndman et al (CSDA, 2011) proposed a method for optimally reconciling forecasts of all the series in a hierarchy to ensure they add up. The optimal reconciliation method involves fitting a linear regression model where the design matrix has one column for each of the series at

the most disaggregated level. Consequently, for large hierarchies with tens of thousands (or even millions) of series, the model is impossible to estimate using standard regression algorithms such as QR decomposition. In this paper, we propose a solution to this problem, exploiting the unique structure of the linear model to efficiently estimate the coefficients, even when there are millions of time series at the most disaggregated level. This makes forecast reconciliation on the largest hierarchies feasible in practice. The algorithm has applications in any situation where large hierarchies of time series need to be forecast, particularly in forecasting demand in product hierarchies, or geographical hierarchies.

ID149 Nikolaos Kourentzes (Lancaster University) - *Duality of Hierarchies in Business Forecasting*, Co-authors: Fotios Petropoulos, Lancaster University; Aris Syntetos, Cardiff University
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Abstract: Organisations often make use of the hierarchical structure of their market or operations for demand planning. Hierarchical forecasting can help improve the accuracy of the relevant decision making series. This is done by taking advantage of aggregate top-level information, such as sales category or market segment, or detailed bottom-level series like the sales of each individual stock keeping unit. The structure of these hierarchies is suitable for decision making and reporting purposes, but often rather complex from a forecasting perspective. For instance, series are arranged in a market segment driven hierarchy, which may imply combining rather heterogeneous information, with potentially adverse effects on forecasting. This research is attempting to define and use "forecasting-optimal" hierarchies that are dual to the decision making hierarchies, i.e. provide outputs relevant to the operations of an organisation, while maximising the accuracy gains due to the hierarchical structure. Empirical evidence of the benefits of dual hierarchies is provided.

ID99   Evangelos Spiliotis (National Technical University of Athens) *Examining the effect of temporal aggregation on forecasting accuracy for hierarchical energy consumption time series*, Co-authors: Fotios Petropoulos, Lancaster University; Nikolaos Kourentzes, Lancaster University; Vassilios Assimakopoulos, University of Athens
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Abstract: Forecasting energy demand in building and device level simultaneously is a complex process. Its performance, in terms of accuracy, depends on both the characteristics of the individual devices and the facility as a whole, not to mention weather conditions and timetables. The structure of the problem lends itself for hierarchical forecasting. We examine the effects of temporal aggregation and forecast combination on forecasting accuracy. Independent forecasts per hierarchical level are produced for several forecasting horizons using the Multi Aggregation Prediction Algorithm, an exponential smoothing based forecasting framework which combines the time-series components across temporal aggregation levels rather than the individual forecasts themselves. Finally, bottom-up, top-down and optimal reconciliation approaches for hierarchies are considered. Empirical conclusions concerning the forecasting accuracy of temporal and structural hierarchies per forecasting horizon are demonstrated by forecasting energy consumption in a two-level hierarchy, consisted of five Greek bank branches and their energy consumption end uses.

TSM12 Nonlinear time series methods
Date: Tuesday July 1, 11:25am-12:45pm
Venue: Plate
Chair: Keith Ord (Georgetown University)

ID47 Stephan Schlueter (Wingas GmbH) - *Wavelet Based Forecasting: An Empirical Comparison of Different Methods*, Co-author: Carola Deuschle, University of Erlangen-Nuremburg
E-mail: stephan.schlueter@wingas.de
Abstract: By means of the wavelet transform a time series can be split into different frequency components. In doing so one is able to identify relevant patters within a time series, and there are different ways to utilize this feature to improve existing time series forecasting methods. However, despite a considerable amount of literature on this topic, there is hardly any work that compares the different wavelet based methods which each other. Here, we try to close this gap. We test various wavelet based methods on four data sets, each with its own characteristics. Eventually, we come to the conclusion that using wavelets does improve the forecasting quality, especially for longer time horizons than one day ahead. However, there is no single superior method: either wavelet based denoising or wavelet based time series decomposition is best. The performance depends on the data set and the forecasting time horizon.

ID68 Fabio H. Nieto (Universidad Nacional de Colombia) - *Forecasting with an open-loop TAR model*, co-author: Luz E. Vargas, Universidad de Cartagena
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Abstract: In this paper, the Bayesian predictive distribution for a variable of interest is proposed, in order to compute their forecasts via an open-loop TAR model. Both informative and noninformative priors for the model parameters are used, obtaining that the first ones leads to better forecasts than the second. A preliminary research of the forecasting performance of this procedure, when it is compared to other models, is presented.

ID264 Menelaos Karanasos (Brunel University) - *The fundamental properties of time varying AR models with nonstochastic coefficients*, co-authors: Alexandros Paraskevopoulos, Brunel University; Stavros Dafnos, Brunel University
E-mail: Menelaos.Karanasos@brunel.ac.uk
Abstract: The paper examines the problem of representing the dynamics of low order autoregressive (AR) models with time varying (TV) coefficients. The existing literature computes the forecasts of the series from a recursion relation. Instead, we provide the linearly independent solutions to TV-AR models. Our solution formulas enable us to derive the fundamental properties of these processes, and obtain explicit expressions for the optimal predictors. We illustrate our methodology and results with a few classic examples amenable to time varying treatment, e.g, periodic, cyclical, and AR models subject to multiple structural breaks.

ID107 Keith Ord (Georgetown University) - *Why are Prediction Intervals so (too?) wide?*

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Abstract: When a non-stationary time series is constrained to be non-negative, theory indicates that it will ultimately increase without limit or that it will converge almost surely to zero. In practice, neither of these situations is typical, although companies do go bankrupt and consumers do turn away from established products. We consider a model with a hidden cointegrated variable that is able to represent both these forms of behavior, but which can also represent situations with mean or trend-reverting behavior. Typically, the cointegrated variable might be measured less frequently than the variable of interest. An implication of these results is that model-based prediction intervals may be seriously biased (too wide?) for longer lead-times and such intervals should be estimated empirically whenever possible, rather than using standard formulas. Data on daily closing prices of the Dow Jones Index are used to illustrate the results.

TSM13 Multivariate time series models

Date: Tuesday July 1, 3:00-4:00pm
Chair: Michel van der Wel (Erasmus University Rotterdam)

ID217 Ines Wilms (KU Leuven) - *Sparse cointegration*, co-author: Christophe Croux, KU Leuven
E-mail: ines.wilms@kuleuven.be
Abstract: Cointegration theory is often used to investigate the long-run equilibrium relation between several time series in levels. However, conventional cointegration tests break down when a large number of variables are available compared to the sample size. In this paper we provide a sparse estimate of the cointegration space by combining a penalized estimation procedure for vector autoregressive models with a sparse canonical correlations analysis. We show in a simulation study that the sparse cointegration procedure provides a significantly more precise estimate of the cointegration space compared to the traditional cointegration approaches. We also discuss a new criterion to determine the cointegration rank of which we illustrate the good performance in several simulation settings. In the first empirical application we investigate whether the expectations hypothesis of the term structure of interest rates, which implies a sparse cointegration space, holds in practice. In the second empirical application, we show that forecast performance in high-dimensional systems might be improved by accounting for the cointegration relationships.

ID235 Henri Nyberg (University of Helsinki) - *A Qualitative Response VAR Model: An Application to Joint Dynamics of U.S. Interest Rates and Business Cycle*
E-mail: henri.nyberg@helsinki.fi
Abstract: This paper introduces a new regime switching vector autoregressive (VAR) model where the regime switching dynamics is described by a qualitative response (QR) variable. Parameters of the QR-VAR model can conveniently be estimated by the method of maximum likelihood and multiperiod forecasts can be constructed using a simulation-based forecasting method. An empirical application shows a strong bidirectional predictive linkage between the U.S. interest rates and NBER business cycle recession and expansion periods. Due to the predictability of the business cycle regimes, the QR-VAR model yields superior out-of-sample forecasts for the interest rate variables compared with the VAR model.

ID226 Michel van der Wel (Erasmus University Rotterdam) – *Dimension Reduction in Large Time-Varying VARs: The DFM-VAR Model*, co-author: Stefano Grassi, University of Kent
E-mail: vanderwel@ese.eur.nl
Abstract: We propose a new parsimonious approach to analyze and forecast large panels of macroeconomic variables. Our approach falls within the model class of Time-Varying Parameter Vector AutoRegressions (TVP-VARs) of large dimensions. Recent innovations in the literature suggest computationally efficient ways to estimate such models, where all coefficients of the VAR vary over time and are treated as factors. Our contribution is to use a Dynamic Factor Model (DFM) for these factors, and we label the corresponding model the DFM-VAR approach. In an illustration we show a small number of factors are capable of capturing a lot of the variation in the factors describing the VAR coefficients. We provide a comprehensive forecasting analysis to examine the costs and benefits of the more parsimonious nature of our DFM-VAR model compared to the regular TVP-VAR model.

TSM14 Exponential smoothing and forecasting

Date: Wednesday July 2, 11:25am-12:45pm
Venue: Hudig
Chair: Michele A. Trovero (SAS Intitute)

ID212   Christoph Bergmeir (Universidad de Granada) - *Bagging Exponential Smoothing Methods using STL Decomposition and Box-Cox Transformation*, Co-authors: Rob Hyndman, Monash University; Jose Benítez, Universidad de Granada
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Abstract: Exponential smoothing is one of the most popular forecasting methods. We present a method for bootstrap aggregation (bagging) of exponential smoothing methods. The bagging uses a Box-Cox transformation followed by an STL decomposition to separate the time series into trend, seasonal part, and remainder. The remainder is then bootstrapped using a moving block bootstrap, and a new series is assembled using this bootstrapped remainder. On the bootstrapped series, an ensemble of exponential smoothing models is estimated. The resulting point forecasts are averaged using the mean. We evaluate this new method on the M3 data set, showing that it consistently outperforms the original exponential smoothing models. On the monthly data, we achieve better results than any of the original M3 participants. We also perform statistical testing to explore significance of the results. Using the MASE, our method is significantly better than all the M3 participants on the monthly data.

ID286   Guckan Yapar (Dokuz Eylül University) - *Forecasting Accuracy Of Modified Exponential Smoothing Method For M-Competition-111 Series*, Co-author: Hanife Taylan, Dokuz Eylul University
E-mail: guckan.yapar@deu.edu.tr
Abstract: In this study, we will propose an alternative smoothing method versus to Brown's Exponential Smoothing Method. The proposed method is obtained by modifying the smoothing parameter of the exponential smoothing. The modification is very simple but results are surprisingly great since it gives more weight to recent observations and less weight to old observations at the same smoothing value used for exponential smoothing method. Furthermore optimum smoothing value and initial value will be obtained simultaneously. Performance of proposed method will be given for simple exponential smoothing and Holt's linear trend method using M-competition-111 series.

ID364   Sven F. Crone (Lancaster University) - *Improving Trend Forecasting in SAP APO DP - an empirical evaluation of different Initialisation Approaches for Holt's Exponential Smoothing*
E-mail: s.crone@lancaster.ac.uk
Abstract: The prediction of trends is preeminent importance for tactical and strategic planning in medium to long-term forecasting horizons. Unfortunately, in practice many companies are struggling in effectively specifying the meta-parameters for Holt's or Brown's Double Exponential Smoothing methods to forecast trends in the software SAP APO DP. With SAP's APO becoming one of the most widely used software systems for demand planning and forecasting, this represents a significant limitation for a large number of multi-national companies across industries, often impairing the overall acceptance of statistical baseline forecasting itself. A root cause analysis of replicating the Exponential Smoothing algorithms outside of SAP APO DP identifies their Naïve initialisation of the trend models as a potential contributing factor. We conduct a large-

scale empirical evaluation of the efficacy of different existing initialisation approaches for trend exponential smoothing, including global, backcasted and optimised initial values, combined with model selection between the aforementioned approaches. Following the recommendations in Tashman (2000) our simulation experiments employ a representative datasets of monthly data from a fast moving consumer goods company, where we assess robust error metrics in a rolling-origin evaluation. Our study identifies the potential for significant improvements in forecast accuracy from selecting an adequate initialisation approach for trend exponential smoothing. The enhanced initialisation approach is made available in a software add-on tool that seamlessly integrates into APO DP, and is currently being rolled-out at the company.

ID322 Michele A. Trovero (SAS Intitute) - *Implementing State-Space-Based Exponential Smoothing Models in SAS*, co-authors: Michael Leonard, SAS Institute; D. Bruce Elsheimer, SAS Institute
E-mail: Michele.Trovero@sas.com
Abstract: The ESMX procedure in SAS/ETS® analyzes and forecasts equally spaced univariate time series data by using single source of error (SSOE) models, which are exponential smoothing models (ESMs) that are based on an innovation formulation of state space models (SSMs). SSOE models assume that the sources of errors are perfectly correlated. Traditional ESM methods, such simple exponential smoothing and Holt-Winters models, can be derived as special cases of these more general classes of SSMs. Currently the ESMX procedure supports the ETS models of Hyndman et al. (2008). Future plans include the support of the BATS and TBATS models of De Livera, Hyndman, and Snyder (2011).

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