Department of Statistics: PhD Presentation Event

Monday 14th and Tuesday 15th June 2010
Leverhulme Library (B617), Columbia House

Abstracts

Deniz Akinc	Pairwise likelihood inference for factor analysis type models

The standard likelihood based inference in Generalized Linear Models with latent variables requires high dimensional integrations that increase heavily the computations. Since exact methods for computing and maximizing the full-likelihood function are usually not feasible, a different approach, called "pairwise likelihood estimation" will be used (Cox and Reid, 2004). The aim of this approach is to reduce the computational complexity without losing information. This method maximizes the likelihood function based on the bivariate probabilities of the responses, which have a simple statistical structure.

First we will give brief information on composite likelihood and its special cases (e.g. pairwise likelihood)
(Varin, 2008). Then we will evaluate the efficiency of pairwise estimation in the case of estimating the mean and covariance matrix of a multivariate normal distribution. We will extent the pairwise estimation to one factor and two factors models with continuous variables. The pairwise estimation will be compared with full maximum likelihood estimation (MLE) and unweighted least squares estimation (ULS) methods. Comparisons will be made on the estimates, standard errors and goodness-of-fit statistics.

Keywords: Pairwise likelihood inference, Multivariate normal distribution, Variance structure, Maximum likelihood Inference

Ref: - Cox, D.R. & Reid, N., 2004, A note on pseudolikelihood constructed from marginal densities, Biometrika, 91 (2), 729 – 73.
- Varin, C., 2008, On the Composite Marginal Likelihoods, Advances in Statistical Analysis, 92 (1), 1 - 28.

Xiaonan Che	Stochastic boundary crossing probability for Brownian motions

We provided an alternative method to obtain the explicit formulae for the distribution of the first-passage time of a Brownian motion through linear boundaries, to which extend, the unconditional probability for the Brownian motion to reach one of two stochastic boundaries is derived, particularly, compound Poisson boundaries with exponential changes. The powerful tool as martingales is applied. The applications of the result especially on payment system are given. Both numerical examples and simulated resulted are provided.

Dan Chen	A Study on the Commodity Future Prices

The purpose of this study is to examine the performance of different measure changing techniques in the incomplete market. In this project, I will analyze several commodity spot and future markets, calibrate the different risk-neutral measures determined by the markets, and then study the property and performance of those calibrated risk-neutral measures.

Haeran Cho	High-dimensional variable selection via tilting

Recent advances in technologies have led to the explosion of datasets across many scientific disciplines, where the dimensionality of the data is very large, and sometimes even larger than the number of observations. In this paper, we propose a method for variable selection in a linear mode where the number of variables exceeds the number of observations. We first introduce a new measure of association between each variable and the response, termed as "tilted correlation", which takes into account the correlation among variables. Then we study the effectiveness of tilted correlation in selecting significant variables over insignificant ones, and present an iterative variable screening algorithm derived from the study. An extensive simulation study is provided to see the finite sample performance of the proposed algorithm.

Flavia Giammarino	Pricing with Uncertainty Averse Preferences

We consider the problem of indifference pricing in the general decision theoretic framework of uncertainty averse preferences. We find that the indifference seller price is the opposite of a quasiconvex risk measure, and that the indifference buyer price is the opposite of a cash-additive convex risk measure. Both indifference prices are in general non-monotonous with respect to the initial wealth, the monotonicity property depending on the attitude towards uncertainty of the decision maker. We conclude providing representation results based on quasiconvex and convex duality.

Sarah Higgins	Seasonal weather forecasting using multi models

A look at what causes uncertainty in seasonal forecasts and how to measure the skill of individual seasonal models and multi models.

Alex Jarman	Quantitative information on climate change for the insurance industry

Extreme weather events such as US hurricanes and European winter storms are responsible for some of the world's greatest economic losses due to natural hazards. Consequently, (re)insurance companies tend to be more financially sensitive to weather-related catastrophes than other types of companies. With the added uncertainty of future climate change which may contribute to an increase in the severity and frequency of extreme weather events it is clearly important for the insurance sector to adapt to the potential impacts. There is a broad and rapidly growing range of information on the economic impact of future climate change currently available but there is still much ongoing discussion and debate regarding the best approach to communicate and utilise this information. This PhD research aims to address some of the open-ended questions of how to effectively exploit and evaluate the impact of climate and climate change information within the insurance sector.

The project has been proposed as part of a wider research programme - sponsored by the reinsurance firm Munich Re - which has been set up to investigate the economics of climate risks and opportunities for the insurance sector. It is to adopt a two-tiered framework to examine and develop methodologies for incorporating climate science into the insurance sector: namely, a "scientific" component, and an "economic" component. Subsequently, a synthesis of the work from the two components will be implemented.

The aim of the scientific component is to review and compare the skill (using conventional measures) of current approaches to climate forecasting with a focus on a selected group of perils, timescales and geographical regions. Such approaches include the use of statistical analysis and climate modelling to produce quantitative forecast information on the frequency and magnitude of extreme weather events on seasonal to decadal timescales. The derived information will also be used to feed into adaptation decision-making case studies featuring in the Munich Re sponsored research. Detailed analyses of both deterministic and probabilistic forecasts and their statistical characteristics are to be carried out so that clearly defined links between forecast skill and economic value for the insurance sector can be identified and established.

The aim of the economic research component is to investigate the effectiveness of incorporating quantitative climate and climate change information into decision-making in the insurance sector. It is important not only to understand user needs but also to appreciate the impact on industry practice that forecast information might have. A review of current practices (including interviews with industry representatives) is to be conducted which will lead to the development of economic metrics to investigate the impact of integrating climate forecast information into insurance underwriting and portfolio management. These metrics will be designed around a model which quantifies the insurance-related loss as a function of the associated forecast variable, e.g. wind speed, in the context of storm loss.

In the final synthesis of the two components, the newly developed economic forecast metrics will be scrutinised against the other conventional forecast skill measures by applying them to cost-benefit estimation scenarios relevant to the real world. This will ideally lead to the development of a robust and reliable framework with which to increase the ability of the insurance industry to adapt and operate more effectively in a world under the threat of climate change.

Jia Wei Lim	Some distributions related to the number of Brownian excursions above and below the origin

Levy's downcrossings theorem provides an alternative representation of local time based on excursions, but few research has been done on the number of Brownian excursions and its relation to local time. In this talk, we present some results relating to Brownian motion and the number of excursions it makes above and below zero. In particular, we found the joint probability of the number of excursions of at least certain lengths that occur on one side or both sides of the origin, taken at an exponential time. In order to obtain this, we used the perturbed Brownian motion developed by Dassios and Wu (2009). The distribution of the number of excursions greater than a certain length, conditioned on the local time, has also been derived.

Malvina Marchese	Asymptotic properties of linear panel estimators in large panels with stationary and nonstationary regressors

The paper studies the asymptotic properties of standard panel data estimators in simple panel regression model with error components disturbances. Both regressors and remainders are allowed to be nonstationary. We show the asymptotic normality of the GLS and fixed effect ,ols and first difference estimators when both ne and T go to infinity. Our results hold under joint limit theory and the rate of convergences vary under different stationarity/nonstationarity assumptions. We then explore the efficiency of the estimators with a Monte Carlo experiment.

Sujin Park	Deformation estimation for high frequency data

We propose to model high frequency price series by a time-deformed Levy process. The deformation function is modeled by a piecewise linear function of a physical time with a slope depending on the marks associated with intra-day transaction data. The performance of a quasi-MLE and an estimator based on a permutation-like statistic is examined. We also consider estimating the deformation function nonparametrically by pulling together many time series.

Felix Ren	Distributions and estimation in Stochastic Flowgraph Models

Stochastic Flowgraph models are one type of multistate stochastic process model that are used to describe time-to-event data. They model stochastic processes that progress through various stages. We present methodology using an algebraic approach to compute the Moment Generating Function (MGF) of the waiting time between states of a Markov process with a finite number of states.

First, we introduce the concepts of flowgraph theory and Mason's rule, which allow us to develop expressions for the moment generating function of the waiting time between two states of interest given the inter-state distributions. The general methods can be applied to any finite state stochastic network that is a Markovian systems and also extend to Semi-Markov process by including non-exponential waiting times. We illustrate this method in series, parallel and loop(i.e. networks with feedbacks) network structures. Next, we invert the MGF into a probability density function and discuss more precisely how the structure of network affects the distribution of waiting time in the exponential case. We compare the Maximum Likelihood method with the Method of Moment for estimating parameters, and discuss a easier-to-implement MGF approach for computing the bias of the MLE to order 1/n.

Filippo Riccardi	A Model for the Limit Order Book

In this work, a model for the Limit Order Book (LOB) is presented. Some properties of the LOB are investigated relying on local times theory. In particular, excursion theory and occupation times formula are used to study the executions in the book. Finally, once a proper definition of avalanche is given, it is possible to achieve some conclusions regarding the LOB size fluctuations.

Roy Rosemarin	Dimension reduction in copula models for estimation of conditional densities

In this talk I would like to discuss a parametric copula-based dimension-reduction method for estimation of conditional density of a stationary independent data. The approach suggests an approximation of the conditional density of a random variable Y given a random d-dimensional vector X by that of Y given θ^{T}X, while θ is chosen to minimise the Kullback-Leibler information distance between the unknown and the approximated conditional densities. The index parameter θ is estimated jointly together with the copula parameters, and consistency of the parameters is shown to hold under mild regularity conditions.

Ilya Sheynzon	Continuous time modelling of market liquidity, hedging and crashes

Theoretical models that explain market crashes can be grouped into four major categories: liquidity shortage, multiple equilibria and sunspot, bursting bubble, and lumpy information aggregation models^[1]. In this paper, we extend the second category liquidity risk model of [2] to a continuous time framework, introduce the sunspot mechanism to switch from one equilibrium to another one, prove that the equilibrium price is a special semimartingale, analyse its properties and dynamics, obtain the formulas describing the distribution of the time to and the size of the next crash. We discuss how we can use the market microstructure theory and Bayesian inference to estimate the parameter values. Finally, we apply numerical techniques (PDE, Volterra integral equations and approximation by piecewise linear boundaries approaches) to estimate the distribution formulas.

[1] M.Brunnermeier, "Asset Pricing under Asymmetric Information - Bubbles, Crashes, Technical Analysis and Herding", Chapter 6, Oxford University Press, 2001
[2] G.Genotte and H.Leland, “Market Liquidity, Hedging, and Crashes”, The American Economic Review, Vol.80, No. 5 (Dec., 1990)