Le Mans Insurance & Finance Risk Colloquium

November 6 and 7, 2014
IRA, Le Mans City

Abstract booklet and schedule

Sponsors

Université du Maine

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LMM

FR n° 2962 du CNRS
Mathématiques
des Pays de Loire

LoLitA

Dynamic models for human Longevity with Lifestyle Adjustments

ACTUARIAT DURABLE
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List of Abstracts

Hansjörg Albrecher: *Insurance risk and the cost of capital.*

The development of rules for the determination of premiums under solvency capital requirements is a classical topic in insurance. In recent years the cost-of-capital method for the determination of risk margins has been advocated, with a particular suggestion for the size of the cost-of-capital rate. In this talk a framework will be developed which considers the viewpoint of regulators, investors and policyholders at the same time, leading to a quantitative approach towards interpreting and justifying the size of such a rate. Some practical implications of this approach are discussed in the context of Solvency II.

Patrice Bertail: *Extreme values statistics for Markov chains with applications to Finance and Insurance.*

As originally pointed out in Rootzen (1988), the extremal behavior of instantaneous functionals of a Harris recurrent Markov chain may be described through the regenerative properties of the underlying chain. The present talk emphasizes the importance of renewal theory and regenerations from the perspective of statistical inference for extremal events. We review and give some extensions of this approach in the framework of extreme values for general markov chains. The proposed methodology consists in splitting up the observed sample path into regeneration data blocks or into data blocks drawn from a distribution approximating the regeneration cycle's distribution, in the general case, when regeneration times cannot be observed. This estimation principle is by no means restricted to the sole markovian setup, but applies to any process for which a regenerative extension can be constructed and simulated from the available data. Then, statistical tools are built over the sequence of maxima over the resulting (variable length) data segments, as if these maxima were i.i.d.. In order to illustrate the interest of this technique, we focus on the question of estimating the sample maximum's tail, the extremal index and the regular variation index by means of the (pseudo-) regenerative method. We also explain how it is possible to test for a change in the" extremal dynamic". To motivate this approach in financial and insurance applications (as well as queuing or inventory models), we will illustrate how these tools may be used in order to estimate ruin probabilities and extremal index, in ruin models with a dividend barrier and to some finance threshold models. We illustrate the results to the CAC40.

Romain Biard: *On the modeling of rare events in ruin theory.*

In this talk, we will discuss about the modeling of rare events (e.g. earthquakes, floodings..) in ruin theory. Classical assumptions of the model will be modified in order to take into account the characteristics of such events. In particular, we will see how we can use heavy-tailed distributions for both claim and inter-arrival times. Some specific dependence structures where the claim distribution is modulated by the past of the process will be investigated too. Asymptotic ruin probabilities will be obtained for these models.

Arthur Charpentier: *Non- and Semi-Parametric Inference for Risk Measures*, joint work with Emmanuel Flachaire.

In this work, we estimate quantiles (and other risk measures) from a nonparametric density estimation based on transformed data. An parametric cumulative distribution function is initially used to transform the data into values over the unit interval, from which a nonparametric density estimation is obtained. Finally, an estimation of the density of the original sample is obtained by back-transformation. This approach may be particularly useful to estimate heavy-tailed distributions. We discuss its implementation and its finite sample properties for density estimation, and for estimation and inference with quantiles.

Boualem Djehiche: *Risk aggregation and stochastic claims reserving in disability insurance.*

We will highlight some results on the connection between claims reserving and risk aggregation for large portfolios. This connection allows for the derivation of a partial differential equation for moments of present values, using a mimicking technique. Moreover, we show how statistical multi-factor intensity models can be approximated by one-factor models, which allows for solving the PDE very efficiently. Finally, we give a numerical example where moments of present values of disability annuities are computed using finite difference methods and Monte Carlo simulations.

Christophe Dutang: *Robust and bias-corrected estimation of the coefficient of tail dependence and probabilities of extreme failure sets,* joint work with Yuri Goegebeur and Armelle Guillou.

Multivariate extreme value statistics deals with the estimation of the tail of a multivariate distribution function based on a random sample. Of particular interest is the estimation of the extremal dependence between two or more variables. Modelling tail dependence is a crucial problem in actuarial science. Tail dependence modelling can be used in the daily work of actuaries, for instance for pricing an excess-of-loss reinsurance treaty. Therefore, accurate modelling of extremal events is needed to better understand the relationship of possibly dependent risks at the tail. We introduce a robust and asymptotically unbiased estimator for the coefficient of tail dependence in multivariate extreme value statistics. The estimator is obtained by fitting a second order model to the data by means of the minimum density power divergence (MDPD) criterion. We also study the estimation of probabilities of extreme failure sets. We introduce a bias-corrected and robust estimator for small tail probabilities also by means of the MDPD technique. The asymptotic properties of both estimators are derived under some mild regularity conditions. We illustrate the practical applicability of the method on actuarial datasets.

Nicole El Karoui: *Two examples in population dynamics*
Different questions arise in longevity modelling which can be better understood by the whole population dynamics. For instance, fertility parameters have a great impact. We illustrate this fact through some examples.

Jose Garrido: *Measuring Risk When Expected Losses Are Unbounded.*

We propose a new method to define coherent risk measures for risks with infinite expectation, such as those characterized by some Pareto distributions. Extensions of the conditional value at risk, the weighted conditional value at risk and other examples are given. Actuarial applications are analyzed, such as extensions of the expected value premium principle when expected losses are unbounded.

Pierre Henry-Labordere: *Numerical schemes for nonlinear PDEs arising in Finance.*

Caroline Hillairet: *Ramsey Rule with Progressive Utility in Long Term Yield Curves Modeling*, joint work with Nicole El Karoui and Mohamed Mrad.

We study a modelization of long term yield curves. Inspired by the economic litterature, we provide a financial interpretation of the Ramsey rule that links discount rate and marginal utility of aggregate optimal consumption. For such a long term modelization, the possibility of adjusting preferences to new economic information is crucial, justifying the use of progressive utility. We first characterize consistent progressive utility of investment and consumption, given the optimal wealth and consumption processes. A special attention is paid to utilities associated with linear optimal processes with respect to their initial conditions, which is for example the case of power progressive utilities. We study the dynamics of the marginal utility yield curve, and give example with backward and progressive power utilities, in a case of a log-normal or affine markets.

Stéphane Loisel: *Impairment of financial assets and news from LoLitA*

In this talk, we introduce several problems related to impairment of financial assets in the IFRS accounting framework. We explain why this problem is important for insurance companies and may be of interest for researchers in actuarial science and mathematical finance, and present some first results drawn from a joint work with J. Azzaz and P. Thérond, and from the works of the DéCAF research project (Dépréciation Comptable d'Actifs Financiers). We conclude with some news from LoLitA and some new pictures of Claude Lefèvre.

Olivier Lopez: *Estimation and goodness-of-fit procedures in multivariate lifetime analysis.*

In this work, we explain how to perform nonparametric estimation of the distribution of a vector of lifetimes. The main difficulty is caused by the presence of censoring and/or truncation phenomena. We develop a new methodology that allows to perform goodness-of-fit procedures and bootstrap methodologies in this framework. The tools are applied to the study of the lifetimes of two members of a same couple. An extension to prospective models for the dependence structure is discussed.

Angus McDonald: *Survival Analysis on Pedigrees: A Marked Point Process Model*

Actuarial modelling of the impact of genetic testing on insurance depends on disease onset rates obtained from the epidemiological literature. In the case of extreme single-gene disorders, these usually take the form of survival studies in which the basic unit is a family pedigree rather than an individual. Retrospective ascertainment of pedigrees has been much discussed in the literature, but not often in connection with survival models. More recently, the advent of presymptomatic genetic testing has introduced a genetic test result as a form of internal covariate. We formulate a marked point process model of disease onset within a pedigree, and show how genetic tests as internal covariates can be factored out of the likelihood. However, retrospective ascertainment remains a problem, and there appears to be no simple adjustment for it, even in the simplest pedigrees. In fact, retrospective ascertainment means that ordinary censoring cannot correctly be dropped from the likelihood.

Philip Protter: *Liquidity Suppliers and High Frequency Trading.*

We provide a mathematical analysis of how high frequency traders profit from their speed with respect to the limit order book. Their profits can be decomposed into two components: The first is due to their ability to execute market orders at limit order prices and without incurring any liquidity costs themselves. The second is by "front running" market orders with limit prices. These trading profits are at the expense of ordinary traders who submit market orders and sophisticated traders who submit limit orders or who use algorithmic trading to split up and execute large trades.

Mogens Steffensen: *Personal Finance and Life Insurance under Separation of Risk Aversion and Elasticity of Substitution.*

In a classical Black-Scholes market, we establish a connection between two seemingly different approaches to continuous-time utility optimization. We study the optimal consumption, investment, and life insurance decision of an investor with power utility and an uncertain lifetime. To separate risk aversion from elasticity of intertemporal substitution, we introduce certainty equivalents. We propose a time-inconsistent global optimization problem, and we present a verification theorem for an equilibrium control. In the special case without mortality risk, we discover that our optimization approach is equivalent to recursive utility optimization with Epstein-Zin preferences in the sense that the two approaches lead to the same result. We find this interesting since our optimization problem has an intuitive interpretation as a global maximization of certainty equivalents and since recursive utility, in contrast to our approach, gives rise to severe differentiability problems. Also, our optimization approach can there be seen as a generalization of recursive utility optimization with Epstein-Zin preferences to include mortality risk and life insurance.

Schedule

- **Thursday 6 – Morning**

  8h30 – Welcome coffee.

  9h30 – Opening session.

  9h45 – C. Hillairet : Ramsey rule with progressive utility in long term yield curves modeling.

  10h30 – P. Protter : Liquidity suppliers and high frequency trading.

  11h15 – S. Loisel : Impairment of financial assets and news from LoLitA.

  12h00 – Lunch.

- **Thursday 6 – Afternoon**

  13h45 – A. Macdonald : Survival analysis on pedigrees, A marked point process model.

  14h30 – P. Bertail : Extreme values statistics for Markov chains with applications to finance and insurance.

  15h15 – Coffee break.

  16h00 – A. Charpentier : Non- and semi-parametric inference for risk measures.

  16h45 – H. Albrecher : Insurance risk and the cost of capital.

  17h30 – J. Garrido : Measuring risk when expected losses are unbounded.

- **Friday 7 – Morning**

  9h15 – M. Steffensen : Personal finance and life insurance under separation of risk aversion and elasticity of substitution.

  10h – Coffee Break.

  10h30 – N. El Karoui : Two examples in population dynamics.

  11h15 – P. Henry-Labordere : Numerical schemes for nonlinear PDEs arising in Finance.

  12h00 – Lunch.

- **Friday 7 – Afternoon**

  13h30 – B. Djehiche : Risk aggregation and stochastic claims reserving in disability insurance.

  14h15 – R. Biard : On the modeling of rare events in ruin theory.

  15h00 – O. Lopez : Estimation and goodness-of-fit procedures in multivariate lifetime analysis.

  15h45 – C. Dutang : Estimation of the tail dependence coefficient and probabilities of extreme failure sets.