9h00 – 9h30 : Vanessa Hanna

Correlated stochastic mortality and interest rates: A pricing approach applied to the mixed contract

The traditional pricing approach in life insurance is based on models for the financial elements and the mortality elements without any correlations between them. However, recent trends, such as the recent COVID-19 pandemic or the effect of ageing on stock market preferences, motivate us to account for the correlation between changes in demographic trends and the value of financial assets. The purpose of this paper is to propose a multi-dimensional approach to studying explicitly the dependence between financial and mortality risks in a joined stochastic continuous time model of interest rates, stock returns, and mortality. We apply the model to the pricing of a novel mixed insurance contract based on longevity and splitting premium payments between a participating and a unit-linked fund, where an additional guarantee fee is applied to the unit-linked return in order to increase the investment guarantee of the participating fund.

9h30 – 10h00 : Alexandre Jacquemain

Parallel computing with R using the CECI clusters

As statisticians, we are constantly confronted with the task of performing Monte-Carlo simulations to illustrate the performance of our procedures. In essence, this most often implies running M independent replicates of the same task. When the task is computationally intensive, e.g. because it involves nested loops, the total computation time may explode. Parallel computing reduces this problem by distributing the tasks across several computer processing units (CPU). A computer cluster is a set of computers working together and may gather up to thousands of CPU. As UCLouvain members, we have free access to the CISM and CÉCI clusters. In this talk, we will present the clusters and their main features. We will show that they can be easily set-up using MobaXterm on Windows. Using a simple example, we will then move on to explain how these clusters can be used to perform simulations with R. Presentation handouts and source files will be provided in advance.

10h00 – 10h30: Hortense Doms

Flexible joint models for time-to-event and non-Gaussian longitudinal outcomes

In medical studies, while the primary interest is often to record the time at which a particular event occurs, information on multiple covariates is also collected longitudinally throughout the follow-up period. This produces a combination of survival and longitudinal information about each individual under the study. Many methods allow the longitudinal and time-to-event responses to be studied separately, but in some situations, it is not appropriate to make a separate analysis. Indeed, longitudinal measurements could have a predictive role in the analysis of patient survival. A new methodology is then developed to measure the association between repeated measurements and the risk of having an event: The joint models for longitudinal and time-to-event data. We first present the general framework of joint modeling for survival and non-Gaussian longitudinal outcomes under the Bayesian paradigm. Then, we propose an extended version of this joint model that considers possible non-linear effects of some survival covariates using Bayesian P-splines.

10h30 – 11h00: Pause

11h00 - 11h30: Shuang Hu

Modelling multivariate extreme value distributions via markov trees

Multivariate max-stable distributions are a primary choice for modelling multivariate extremes. In high dimension, however, their construction is challenging. We propose a method based on graphical models which consists of combining bivariate max-stable distributions in a tree.

A Markov tree is a random vector indexed by the nodes of a tree and satisfying the global Markov property. Its joint distribution is totally determined by those of pairs of variables along the edges of the tree. Under proper conditions, partial maxima of samples from a Markov tree converge to a max-stable distribution. Under the assumption that the data-generating distribution is in the domain of attraction of a max-stable distribution, we construct a Markov tree by letting each connected pair of variables have the same distribution as the corresponding bivariate margin of the max-stable distribution. The constructed Markov tree is shown to belong to the domain of attraction of another max-stable distribution which inherits its dependence structure from the tree. This second max-stable distribution serves as a tree-based approximation to the first one, fully determined by the tree structure and certain bivariate margins.

Given the data, we learn the tree structure of the maximum weighted tree by applying Prim's algorithm based on estimates of three commonly used bivariate dependence measures: upper tail dependence coefficients, Kendall's τ and Spearman's ρ. Once the tree structure is settled, several estimation methods are used to estimate the distributions of pairs of connected variables. The constructed Markov tree and its max-stable attractor can be used for inference on probabilities of rare events in high dimension.

11h30 - 12h00: Linqi Wang

Dynamic portfolio selection with sector-specific regularization

A new algorithm is proposed for dynamic portfolio selection that takes a sector-specific structure into account. Regularizations with respect to within- and between-sector variations of portfolio weights, as well as sparsity and transaction cost controls, are considered. The model includes two special cases as benchmarks: a dynamic conditional correlation model with shrinkage estimation of the unconditional covariance matrix, and the equally weighted portfolio. An algorithm is proposed for the estimation of the model parameters and the calibration of the penalty terms based on cross-validation. In an empirical study, it is shown that the within-sector regularization contributes significantly to the reduction of out-of-sample volatility of portfolio returns. The model improves the out-of-sample performance of both the DCC with nonlinear shrinkage and the equally-weighted portfolio.

12h00 - 12h30: Stefka Asenova

Linear graphical models with heavy tail factors on trees of transitive tournaments

Linear graphical models with heavy tail factors can be used to model extremal dependence or causality between extreme events. A linear graphical model is a structural equation model where a variable is recursively defined in terms of its parents according to a graph. If the graph is acyclic (DAG) the model is known as Bayesian network. In this paper we consider a graphical model with respect to a special type of DAG, as we called it a tree of transitive tournaments. It is a graph combining in a tree-like structure finite number of transitive tournaments. A transitive tournament is a directed acyclic graph where every two nodes are connected. We study the limit of the tails of such graphical models conditional on the event that a high threshold is exceeded and we show that the limit factorizes along the unique shortest trail between two variables. We are also interested in a condition that guarantees that the parameters of the distribution of the complete random vector are identifiable in case we are able to observe only a subvector.

12h45 – 14h: Lunch break ???