L^2 ISFA Lyon and DSA-HEC Lausanne

Tuesday, January 19, 2021

ONLINE

- 9 h 30 DIALING-IN and OPENING

https://univ-lyon1.webex.com/univ-lyon1-en/j.php?MTID=mfd927d09711767cef591fa72c44c55be
Meeting number (access code): 121 300 9642 No password

- 10 h 00 **Karim BARIGOU** (ISFA)
  Pricing equity-linked life insurance contracts with multiple risk factors by neural networks
- 10 h 45 Discussion by Aleksandr SHEMENDYUK (UNIL)

- 11 h 00 Phd talk #1: **Pierre CHATELAIN** (ISFA)
  Linear regression and data quality through individualized credibility index
- 11 h 20 Q&A's by UNIL PhD students

- 11 h 30 Networking Session

- 12 h 00 LUNCH BREAK

https://univ-lyon1.webex.com/univ-lyon1-en/j.php?MTID=mfd927d09711767cef591fa72c44c55be
Meeting number (access code): 121 300 9642 No password (same link for morning and afternoon)

- 13 h 30 Phd talk #2: **Krzysztof BISEWSKI** (UNIL)
  A generalization of Kolmogorov-Smirnov test using partial sorting
- 13 h 50 Q&A's by ISFA PhD students

- 14 h 00 Phd talk #3: **Sarah BENSALEM** (ISFA)
  A Continuous-Time Model of Self-Protection
- 14 h 20 Q&A's by UNIL PhD students

- 14 h 30 Phd talk #4: **José Miguel FLORES CONTRO** (UNIL)
  Is microinsurance alone an appropriate risk coping mechanism for low-income individuals?
- 14 h 50 Q&A's by ISFA PhD students

- 15 h 00 **Ruodu WANG** (UNIL)
  Goodhart's law and risk optimization
- 15 h 45 Discussion by Tachfine EL ALAMI, Rayane VIGNERON and Stéphane LOISEL (ISFA)

- 16 h 00 CLOSING

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ABSTRACTS

Karim BARIGOU: *Pricing equity-linked life insurance contracts with multiple risk factors by neural networks*

Abstract: This paper considers the pricing of equity-linked life insurance contracts with death and survival benefits in a general model with multiple stochastic risk factors: interest rate, equity, volatility, unsystematic and systematic mortality. We price the equity-linked contracts by assuming that the insurer hedges the risks to reduce the local variance of the net asset value process and requires a compensation for the non-hedgeable part of the liability in the form of an instantaneous standard deviation risk margin. The price can then be expressed as the solution of a system of non-linear partial differential equations. We reformulate the problem as a backward stochastic differential equation with jumps and solve it numerically by the use of efficient neural networks. Sensitivity analysis is performed with respect to initial parameters and an analysis of the accuracy of the approximation of the true price with our neural networks is provided.

Pierre CHATELAIN: *Linear regression and data quality through individualized credibility index*

Abstract: Many statistical applications set the question of data quality aside. However, data quality is a fundamental concern inherent in external data collection. In this work, we study how to integrate the information on data quality in linear regressions. A new algorithm is introduced to take into account individualized quality indexes related to the confidence we can have in covariate values. In this view, we suggest a latent variable model that drives the generation of the covariates, and study various frameworks depending on the correlation structure underlying the covariates. Our technique provides unbiased estimators of the regression coefficients and allows to make robust predictions using the individualized quality indexes. Keywords: Credibility, Quality index, OLS Regression

Krzysztof BISEWSKI: *A generalization of Kolmogorov-Smirnov test using partial sorting*

Abstract: Kolmogorov-Smirnov test is one of the most fundamental tests for testing whether the given sample $X_1, \ldots, X_n$ is iid with a given cumulative distribution function F() --- typically F() is a normal cdf. It relies on the fact that properly scaled distance between F() and the empirical cdf F_n() converges weakly to KS distribution and this limit does not depend on F. The empirical cdf can be constructed by sorting the original sample. It turns out that even partial sorting can be enough to construct a test analogous to the one of Kolmogorov Smirnov. In this presentation, we will show how to construct such a test using a partial bubble sort algorithm and examine its asymptotic behavior.
This is joint work with Marijn Jansen (TU Delft, The Netherlands) and Yoni Nazarathy (University of Queensland, Australia).

Sarah BENSALEM: *A Continuous-Time Model of Self-Protection*

Abstract: This paper deals with an optimal linear insurance demand model, where the protection buyer can also exert time-dynamic costly prevention effort to reduce her risk exposure. This is expressed as a stochastic control problem, in which the agent maximizes an exponential utility of her terminal wealth. We assume that the effort reduces the intensity of the jump arrival process, and we interpret this as dynamic self- protection. We

solve the problem using a dynamic programming principle approach, and we provide a representation of the value function using a particular backward SDE. This allows us to solve the problem explicitly: we identify the dynamic certainty equivalent of the agent, and prove that the dynamic effort is actually constant, for a large class of loss processes. This shows in particular that the Lévy property is preserved under exponential utility maximization. We also characterize the constant effort as a the unique minimizer of an explicit Hamiltonian, from which we can determine the optimal effort in particular cases. Finally, after studying the dependence of the BSDE on the linear insurance contract parameter, we prove the existence of an optimal linear cover, that is not necessarily zero or full insurance.

José Miguel FLORES CONTRO: *Is microinsurance alone an appropriate risk coping mechanism for low-income individuals?*

Abstract. Microinsurance is a type of insurance that focuses on designing insurance solutions for the lower income classes, which are distinguished for being individuals living close to the poverty line. At the same time, the trapping time refers to the time when a household falls into the area of poverty. This article considers a classical Poisson risk-type model for households' capital. We illustrate how by analytical techniques, closed-form expressions for the Laplace transfor of the trapping time, can be derived for exponentially distributed losses encountered by individuals. Microinsurance is then introduced to analyze its impact on the probability of becoming poor. The results validate those previously obtained with this type of models, certifying that microinsurance alone is not sufficient to reduce the chances of falling into the area of poverty for specific groups of people, since premium payments constrain household's capital growth, consequently indicating that additional aid is required. Therefore, we investigate two different premium subsidies strategies and the effect of bundling microloans with microinsurance products in order to determine if such approaches may help in reducing poverty. Finally, numerical illustrations are provided. The talk is based on joint work with Séverine Arnold, Corina Constantinescu and Kira Henshaw.

Ruodu WANG: *Goodhart's law and risk optimization*

Abstract: Goodhart's law, named after British economist Charles Goodhart, states that "When a measure becomes a target, it ceases to be a good measure". We discuss this law in the context of risk optimization in banking regulation, where the target measure is a regulatory risk measure. The two most important regulatory risk measures, Value-at-Risk (VaR) and Expected Shortfall (ES), have given rise to many debates over the past few years on their comparative advantages, where robustness issues become a crucial consideration. By introducing and analyzing the concept of robustness in optimization, we obtain a "second Goodhart's law for risk measures": As regulatory target, all risk measures cease to be good, but some risk measures are much worse than the others. In particular, VaR is seriously problematic in this regard, in sharp contrast to commonly used convex risk measures like ES. This talk is based on joint work with Paul Embrechts (ETH Zurich) and Alexander Schied (Waterloo).
A corresponding paper (with a different title) is found on SSRN:
https://ssrn.com/abstract=3254587