Workshop – CREMMA 9
Stochastic Control & Mean Field Games and Applications
Mercredi 24 avril 2019, 9h-13h
Salle UNESCO, LAMSIN-ENIT, UTM

9h00 – 9h30 : Monique PONTIER (Institut Mathématiques de Toulouse)
Pricing of American Option of Barrier type

9h30 – 10h : Caroline HILLAIRET (ENSAE)
Aggregation of heterogeneous consistent progressive utilities

10h00 – 10h30 : Alexandre POPIER (Le Mans Université)
A Mean Field Game of Optimal Portfolio Liquidation

10h30 – 11h : PAUSE CAFÉ

11h00 – 11h30 : Mohamed MRAD (Université Paris 13)
Recover Dynamic Utility and application to the economic equilibrium

11h30 – 12h : Nicolas BARADEL (ENSAE)
Optimal inventory management and order modeling

12h00 – 12h30 : Sarah NEFFATI (Le Mans Université & ENIT- UTM)
Viscosity solutions of systems of PDEs with interconnected obstacles without monotonocity condition

12h30 – 13h : Ishak HAJJEJ (ENSAE & ENIT-UTM)
Optimal stopping contract for public-private partenarships under moral hazard

Organisateurs : Anis MATOUSSI, Mohamed MNIF, Habib OUERDIANE, Nizar TOUZI

ABSTRACTS

Nicolas BARADEL (ENSAE)

Title : *Optimal inventory management and order modeling*

Abstract : We model the behavior of three agent classes acting dynamically in a limit order book of a financial asset. Namely, we consider market makers (MM), high-frequency trading (HFT) firms, and institutional brokers (IB). Given a prior dynamic of the order book, similar to the one considered in the Queue-Reactive models [14, 20, 21], the MM and the HFT define their trading strategy by optimizing the expected utility of terminal wealth, while the IB has a prescheduled task to sell or buy many shares of the considered asset. We derive the variational partial differential equations that characterize the value functions of the MM and HFT and explain how almost optimal control can be deduced from them. We then provide a first illustration of the interactions that can take place between these different market participants by simulating the dynamic of an order book in which each of them plays his own (optimal) strategy.

Ishak HAJJEJ (ENSAE & ENIT-UTM)

Title : *Optimal stopping contract for public-private partenarships under moral hazard*

Abstract : We extend the Hajjej et al. (2017) model to an optimal stopping problem. We assume that the public ("she") pays a rent to the consortium ("he"), while the latter gives a best response characterized by his effort until a terminal date decided by the public when she stops the contract and gives compensation to the consortium. We solve the second-best problem associated with this framework. The value function is characterized as the solution of the corresponding Hamilton Jacobi Bellman Variational Inequality. We characterize the optimal strategy by the solution of the variational inequality which we solve numerically by using the Howard algorithm and we show that the optimal rent is not a linear function of the effort.

Caroline HILLAIRET (ENSAE, Paris-Saclay)

Title : *Aggregation of heterogeneous consistent progressive utilities*

Abstract: We aim to describe globally the behavior and preferences of heterogeneous agents. Our starting point is the aggregate wealth of a given economy, with a given repartition of the wealth among investors, which is not necessarily Pareto optimal. We propose a construction of an aggregate forward utility, market consistent, that aggregates the marginal utility of the heterogeneous agents. This construction is based on the aggregation of the pricing kernels of each investor. As an application we analyze the impact of the heterogeneity and of the wealth market on the yield curve.

Mohamed MRAD (Université Paris 13)
Title: *Recover Dynamic Utility and application to the economic equilibrium*

Abstract : We are interested in the forward-looking inverse problem, where the observable are a so-called characteristic process X^c and an initial utility function U(0,.) =u(.). The recovery process is a dynamic (eventually random) utility performance U. The main result is a necessary and sufficient condition for the existence of a utility performance process U satisfying $U(t,X_t^c(x))$ is a martingale for any initial starting point x. An interesting application is considered to completely solve the Markov economic equilibrium.

Sarah NEFFATI (Le Mans Université & ENIT- UTM)
Title: *Viscosity solutions of systems of PDEs with interconnected obstacles without monotonocity condition*

Abstract: We show the existence and uniqueness of a continuous viscosity solution of a system of partial differential equations (PDEs for short) without assuming the usual monotonicity condition on the driver function. Our method strongly relies on the link between PDEs and reflected backward stochastic differential equations with interconnected obstacles for which we already know that the solution exists and is unique for general drivers.

Monique PONTIER (Institut Mathématiques de Toulouse)
Title: *Pricing of American Option of Barrier type*

Abstract: We focus here an up-and-out barrier put option of American type. Its payoff depends on whether the underlying asset's price reaches a certain price level U depending on time. More precisely, it is an ordinary option which ceases to exist when the barrier U is reached by the price S of its underlying asset, i.e. U < S. We are interested in the pricing of this kind of option and we study the first optimal time for such a barrier option. The problem is reduced to a differential system. The existence and the uniqueness of a solution to this system is proved. A numerical part provides a numerical solution to this optimal problem.

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