Seminar & Events Bulletin: Financial/Actuarial Mathematics

07-01-2011 to 08-31-2012

Thursday, September 22, 2011	
3:00pm-4:00pm	**Financial/Actuarial Mathematics** -- Kasper Larsen (Carnegie Mellon University) *Unspanned endowment and dynamical programming with face-lifting* -- 3088 East Hall

Thursday, September 29, 2011	
3:00pm-4:00pm	**Financial/Actuarial Mathematics** -- Yu-Jui Huang (University of Michigan) *On the Multi-dimensional controller and stopper games* -- 3088 East Hall

Thursday, October 06, 2011	
3:00pm-4:00pm	**Financial/Actuarial Mathematics** -- Arash Fahim (University of Michigan) *Optimal Production Policy under the Carbon Emission Market* -- 3088 East Hall

Thursday, October 13, 2011	
3:00pm-4:00pm	**Financial/Actuarial Mathematics** -- Olympia Hadjiliadis (CUNY) *Preventing market crashes through insuring the speed of drawdowns* -- 3088 East Hall

Thursday, October 27, 2011	
3:00pm-4:00pm	**Financial/Actuarial Mathematics** -- Tomoyuki Ichiba (University of California at Santa Barbara) *On collision of Brownian particles and applications* -- 3088 East Hall

Tuesday, November 29, 2011	
4:00pm-5:00pm	**Financial/Actuarial Mathematics** -- Ioannis Karatzas (Columbia University & INTECH) *Stable Diffusions Interacting through Their Ranks, as Models of Large Equity Markets* -- See Colloquium page

Thursday, December 08, 2011	
3:00pm-4:00pm	**Financial/Actuarial Mathematics** -- Marcel Nutz (Columbia University) *Duality and Superreplication under Model Uncertainty* -- 3088 East Hall

Thursday, January 19, 2012	
3:00pm-4:00pm	**Financial/Actuarial Mathematics** -- Sergey Nadtochiy (Oxford) *MARKET-BASED APPROACH TO MODELING DERIVATIVES PRICES* -- 3088 East Hall

Thursday, February 02, 2012	
3:00pm-4:00pm	**Financial/Actuarial Mathematics** -- Yan Dolinsky (ETH) *Limit Theorems for Partial Hedging under Transaction Costs* -- 1360 East Hall

Thursday, February 16, 2012	
3:00pm-4:00pm	**Financial/Actuarial Mathematics** -- Mario Ghossoub (University of Montreal) *On a Class of Monotone Comparative Statics Problems under Heterogeneous Uncertainty, with an Application to Insurance.* -- 1360 East Hall

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Thursday, February 23, 2012	
3:00pm-4:00pm	**Financial/Actuarial Mathematics** -- Philip Protter (Columbia University) *Can one detect a bubble in real time?* -- 1360 East Hall

Thursday, March 08, 2012	
3:00pm-4:00pm	**Financial/Actuarial Mathematics** -- Dennis Ikpe (University of Cape Town) *American-style derivatives: State space representation and filtering techniques* -- 1360 East Hall

Monday, April 09, 2012	
3:00pm-4:00pm	**Financial/Actuarial Mathematics** -- Jianfeng Zhang (USC) *Viscosity Solutions of Path Dependent PDEs* -- 1360 East Hall

Thursday, April 12, 2012	
3:00pm-4:00pm	**Financial/Actuarial Mathematics** -- Manuel Morales (University of Montreal) *On the Ruin Problem for Levy Insurance Risk Processes: A Review and a New Family of Models* -- 1360 East Hall

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Abstracts

Financial/Actuarial Mathematics
Thursday, September 22, 2011, 3:00pm-4:00pm
3088 East Hall
Kasper Larsen (Carnegie Mellon University)
Unspanned endowment and dynamical programming with face-lifting

We will study the relation between optimizing over finite additive and countable additive probability measures. Standard arguments show that the optimizer is always attained in the finite additive class. We will then discuss and derive the influence a possible singular component has on the value function close to maturity.

Joint with Gordan Zitkovic.

Financial/Actuarial Mathematics
Thursday, September 29, 2011, 3:00pm-4:00pm
3088 East Hall
Yu-Jui Huang (University of Michigan)
On the Multi-dimensional controller and stopper games

We consider a zero-sum stochastic differential controller-and-stopper game in which the state process is a controlled diffusion evolving in a multi-dimensional Euclidean space. In this game, the controller affects both the drift and the volatility terms of the state process. Under appropriate conditions, we show that the game has a value and the value function is the unique viscosity solution to an obstacle problem for a Hamilton-Jacobi-Bellman equation.

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Financial/Actuarial Mathematics
Thursday, October 06, 2011, 3:00pm-4:00pm
3088 East Hall
Arash Fahim (University of Michigan)
Optimal Production Policy under the Carbon Emission Market

The aim of this paper is to address the effect of the carbon emission market on the production policy of the emitting production firms. We investigate this effect in the cases where there is no large carbon producer, where there is a large producer who can not affect the risk premia, and where there is a large producer who can change the risk premia by its production. We ignore any possible investment of the production firm in pollution reducing technologies. We formulate optimal production policy by a stochastic optimization problem. Then, we show that the market reduces the optimal production policy of the small producer and the large producer who does not affect the risk premia of the market. However, dependent on the way the large producer activities change the market risk premia, the large producer can optimally produce more than what she used to do before the existence
of the emission market.

Financial/Actuarial Mathematics
Thursday, October 13, 2011, 3:00pm-4:00pm
3088 East Hall
Olympia Hadjiliadis (CUNY)
Preventing market crashes through insuring the speed of drawdowns

In this work we derive analytical formulas for the joint distribution of the drawdown, the last visit time of the maximum of a process preceding the drawdown and the maximum of the process under general diffusion dynamics. The motivation for this work arises in the financial risk management of drawdowns.
Drawdowns measure the first time the current drop of an investorÃ¢â‚¬â„¢s wealth from its historical maximum reaches a pre-specified level. Therefore a quantity related to the drawdown is the duration of time between the drawdown and the last time at which the maximum was achieved. This quantity is studied here.

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Financial/Actuarial Mathematics
Thursday, October 27, 2011, 3:00pm-4:00pm
3088 East Hall
Tomoyuki Ichiba (University of California at Santa Barbara)
On collision of Brownian particles and applications

In this talk we examine the colliding behavior of Brownian particles which diffuse on the real line determined by a class of stochastic differential equations. The absence and the presence of triple (or higher order) collisions among the particles are crucial in analysis of local time processes accumulated by these collisions. Especially, this analysis sheds light on some important characteristics (e.g., identification, solvability, time-reversal, invariant distributions, large deviations) of the stochastic system with discontinuous or degenerate coefficients. As case studies, we consider a financial equity market model with rank based characteristics as well as a systemic risk analysis of interbank lending system.

Financial/Actuarial Mathematics
Tuesday, November 29, 2011, 4:00pm-5:00pm
See Colloquium page
Ioannis Karatzas (Columbia University & INTECH)
Stable Diffusions Interacting through Their Ranks, as Models of Large Equity Markets

Financial/Actuarial Mathematics
Thursday, December 08, 2011, 3:00pm-4:00pm
3088 East Hall
Marcel Nutz (Columbia University)
Duality and Superreplication under Model Uncertainty

We consider the problem of superreplication under Knightian uncertainty in a discrete-time financial market. In the absence of a reference probability measure, we develop a duality theory which is based on a locally convex vector space and allows to treat measurable quantities without further topological restrictions. We obtain the existence of an optimal strategy and a duality relation between (non-equivalent) martingale measures and superreplicable claims. The continuum hypothesis plays an important role in our approach.

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Financial/Actuarial Mathematics
Thursday, January 19, 2012, 3:00pm-4:00pm
3088 East Hall
Sergey Nadtochiy (Oxford)
MARKET-BASED APPROACH TO MODELING DERIVATIVES PRICES

Most classical models for derivatives prices focus on prescribing the time evolution of the underlying stochastic factors. The prices of derivatives are then computed, for example, via the risk-neutral expectations. As markets developed and many derivative contracts became liquidly traded, it appeared necessary, in order to avoid creating arbitrage opportunities and to fully exploit the infor- mation given by the market, to calibrate such models so that they reproduce the observed derivatives prices. However, the calibration results may vary significantly from day to day, implying that none of the calibrated models can be used to describe the future time evolution of the derivatives prices and, in particular, study the risks associated with them.
The idea of the market-based approach is to model the derivatives prices directly, as the prices of generic financial assets. This approach allows to start a model from an arbitrary combination of derivatives prices currently observed in the market, without having to change (recalibrate) the model. In this presentation, I will outline the main problems associated with the construction of a market-based model and will present the general methodology which provides solutions to these problems. I will also give an overview of the existing constructions of the market-based models, starting with the famous Heath-Jarrow-Morton theory, and show how these results agree with the general method. Finally, I will illustrate the theory by constructing (both mathematically and numerically) a family of market-based models for the European call options of multiple strikes and maturities.

Financial/Actuarial Mathematics
Thursday, February 02, 2012, 3:00pm-4:00pm
1360 East Hall
Yan Dolinsky (ETH)
Limit Theorems for Partial Hedging under Transaction Costs

We study shortfall risk minimization for American options with path dependent payoffs under proportional transaction costs in the Black--Scholes (BS) model.
We show that for this case the shortfall risk is a limit of similar terms in an appropriate sequence of binomial models. Furthermore, we use the binomial models in order to construct an "almost" optimal hedges for the BS model. We also
prove that in the continuous time BS model, there exists a portfolio strategy which minimizes the shortfall risk.

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Financial/Actuarial Mathematics
Thursday, February 16, 2012, 3:00pm-4:00pm
1360 East Hall
Mario Ghossoub (University of Montreal)

On a Class of Monotone Comparative Statics Problems under Heterogeneous Uncertainty, with an Application to Insurance.

We examine a class of monotone comparative statics problems under uncertainty that arise naturally in many areas of economic theory, but that cannot be solved directly using the classical Topkis-Milgrom-Shannon-Athey techniques. The objective function is an aggregation of some function U with respect to some probability measure P, and the constraint set contains some "aggregation constraint" (e.g. a risk measure constraint) which is not necessarily P-law-invariant. This introduces some heterogeneity in the perception of uncertainty. The primitive U is a function of some underlying random variable X and of a contingent claim Y on X. The choice variable is Y, and conditions on the primitive U and the "aggregation constraint" so that the problem admits a solution which is a nondecreasing function of X are desired. Under a consistency requirement on the "aggregation constraint" that will be called "Vigilance", supermodularity of the primitive U is sufficient for monotone comparative statics to hold. It is shown that in most situations, the assumption of Vigilance is (strictly) weaker than the usual assumption of a Monotone Likelihood Ratio, when the latter can be defined. As an application, we extend the Arrow-Borch-Raviv classical model of demand for insurance contracts to situations of heterogeneous beliefs, and show that an optimal indemnity schedule for the insurance buyer takes the shape of what we call a "generalized deductible contract". Moreover, the class of all optimal insurance contracts for the insurance buyer that are nondecreasing in the loss is fully characterized in terms of their distribution for the insurance buyer.

Financial/Actuarial Mathematics
Thursday, February 23, 2012, 3:00pm-4:00pm
1360 East Hall
Philip Protter (Columbia University)

Can one detect a bubble in real time?

Recent advances in the mathematical modeling of financial bubbles has led to the observation that bubble detection often boils down to determining if, under the risk neutral measure, a process is a strict local martingale or a true martingale. Bubbles are fairly easily recognizable after the fact, once they have run their course, but it is often difficult to detect their presence in real time. There are few tools available to distinguish a martingale from a strict local martingale, and it seems that determining which is the case from data is a delicate procedure. Indeed, one can argue that in principle it is impossible. Nevertheless in this talk we will explain how, in a special case, there is hope that one can determine when a bubble is present, and when it is not, in real time. The talk is based on joint work with Robert Jarrow and Younes Kchia.

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Financial/Actuarial Mathematics
Thursday, March 08, 2012, 3:00pm-4:00pm
1360 East Hall
Dennis Ikpe (University of Cape Town)
American-style derivatives: State space representation and filtering techniques

The Mathematical formulation of the price of an American-style derivative under the no arbitrage option valuation theory is well established. However, studies on the computational problems of the value of timing investment decision have continued today, yielding occasionally new insight into the development of robust and more efficient computational techniques. The main aim of my PhD research is to study different formulations of American options valuation, as well as existing computational techniques with the goal of obtaining a general state space representation of the value of an American option. Once the state space form is set up, appropriate filtering technique is employed to obtain the price of the option. In this talk, I will use the classical example of American Put option to illustrate the idea of state space representation of the value of American style derivative. Numerical examples will be presented as well.

Financial/Actuarial Mathematics
Monday, April 09, 2012, 3:00pm-4:00pm
1360 East Hall
Jianfeng Zhang (USC)
Viscosity Solutions of Path Dependent PDEs

It is well known that Markovian BSDEs (resp. 2BSDEs) provides a probabilistic representation for the viscosity solution of a semi-linear (resp. fully nonlinear) parabolic PDE. In this talk we shall introduce a type of parabolic Path Dependent PDEs (PPDEs, for short) and propose a notion of its viscosity solutions, and thus extends the above results to non-Markovian (or path dependent) cases. As in the viscosity theory of standard PDEs, we shall prove the existence, uniqueness, and stability of viscosity solutions. The crucial step for uniqueness is to prove the comparison principle. In standard theory, the arguments rely heavily on the compactness of the state space, which is not true in the path dependent case. We decompose the problem into a partial comparison principle and a variation of the Peron's method.

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Financial/Actuarial Mathematics
Thursday, April 12, 2012, 3:00pm-4:00pm
1360 East Hall
Manuel Morales (University of Montreal)
On the Ruin Problem for Levy Insurance Risk Processes: A Review and a New Family of Models

Expressions for the expected discounted penalty function now exist for a wide range of models, in particular for a general class of Levy insurance risk processes [Biffis and Morales (2010) and Biffis and Kyprianou (2010)]. Indeed, the EDPF encapsulates relevant information about ruin related quantities that are of potential interest in risk management applications. Yet, in order to realize this potential, at least one main condition is needed, namely, these expressions must be computationally tractable enough as to allow for the evaluation of associated risk measures such as VaR or CVaR. Now, most of the LÃ©vy models studied so far offer few interesting examples for which computation of the associated EDPF can be carried out to the last instances where evaluation of risk measures is possible. In this paper we address this issue with a new family of models. First, we introduce examples of risk insurance processes for which numerical evaluati