First Congress of Greek Mathematicians
Special Session in Mathematical Finance
June 26, 2018

Organizers

Michail Anthropelos – Athanasios Giannakopoulos – Antonis Papapantoleon

Time Schedule of Talks

	Tuesday, June 26
17:00 – 17:20	Tsekrekos
17:20 – 17:40	Melas
17:40 – 17:50	*break*
17:50 – 18:10	Kolliopoulos
18:10 – 18:30	Papanicolaou

Speakers

Nikolaos Kolliopoulos (University of Oxford)
Stochastic evolution equations for large portfolios of Stochastic Volatility models

We consider a large market model of defaultable assets in which the asset price processes are modeled as Heston-type stochastic volatility models with default upon hitting a lower boundary. We assume that both the asset prices and their volatilities are correlated through systemic Brownian motions. We are interested in the loss process that arises in this setting and we prove the existence of a large portfolio limit for the empirical measure process of this system. This limit evolves as a measure valued process and we show that it will have a density given in terms of a solution to a stochastic partial differential equation of filtering type in the two-dimensional half-space, with a Dirichlet boundary condition. We employ Malliavin calculus to establish the existence of a regular density for the volatility component, and an approximation by models of piecewise constant volatilities combined with a kernel smoothing technique to obtain existence and regularity for the full two-dimensional filtering problem. We are able to establish good regularity properties for solutions, but uniqueness remains an open problem. Finally, we study the asymptotic behaviour of certain functionals of a solution to this stochastic initial-boundary value problem when the mean-reversion coefficients of the volatilities are multiplied by a parameter that tends to infinity. The outcomes of this analysis can be used to improve the accuracy of certain risk-management methods in markets where large volatility mean-reversion is observed (a very common feature).

Evangelos Melas (National and Kapodistrian University of Athens, Department of Economics)
New solutions in terms of quadratures to the CEV model

It is rather intriguing that many of the equations which arise in the Mathematics of Finance are richly endowed with symmetry. These symmetries offer an invaluable device in order to study their solution spaces. This can be accomplished by using group theory in two distinct, complementary, but not overlapping ways: By using Galois theory in the form of Kovacics algorithm and by using Lie point symmetries in order to probe the solution spaces of these equations. We use both in order to find new solutions to the CEV model. By using Kovacics algorithm, which finds all solutions in quadratures of linear

second order ordinary differential equations with rational function coefficients, we find new solutions to the CEV ODE, and then by separation of variables, new associated solutions to the CEV PDE. Subsequently by deriving and using the Lie point symmetries of the CEV PDE we derive new solutions to the CEV model from the solutions we obtained to the CEV model by Kovacics algorithm. Finally we discuss the significance of the solutions we derived for the pricing of financial instruments.

Andrew Papanicolaou (NYU Tandon School of Engineering)

Consistent Inter-Model Specification for Stochastic Volatility and VIX Market Models

This talk addresses the following question: if a stochastic model is specified for the curve of VIX futures, what are the restrictions in order for it to be consistent with a stochastic volatility model? In other words, assuming that a stochastic volatility model is in place, a so-called market model will need to satisfy some conditions in order for there to not be any inter-model arbitrage or mis-priced derivatives. The present work gives such a condition, and also shows how to recover the correctly specified stochastic volatility function from the market model.

Andrianos E. Tsekrekos (Department of Accounting and Finance, Athens University of Economics and Business)

A Real Options Explanation for Discouraged Bank Borrowers

Discouraged firms are those who need credit but do not apply due to fear of rejection. Despite the high prevalence of the discouragement phenomenon, the literature regarding its root causes is scant. We develop a structural financial explanation based on Real Options and derive testable implications, which we investigate using data for Eurozone SMEs. Based on a Bivariate Probit with Selection, where the Selection rule is the need for credit and the Outcome equation the discouragement, we show that Real Option effects account for the variation between discouraged and non-discouraged firms, explained by the perceived probability of application acceptance, application cost, uncertainty and irreversibility.