Project Update – Michael Tehranchi

My PhD student, Si Cheng, and I are developing new classes of stochastic processes, suitable for modelling interest rates. Furthermore, we are working to apply these ideas to model the volatility surface with the aim to provide tractable dynamics of vanilla equity derivatives, and hence facilitate their use as hedging instruments.

Another PhD student, David Driver, and I are studying a certain non-linear partial differential equation that arises from a natural optimal investment problem. Coincidentally, this same equation appears in other areas of mathematics as well as in applications to biology and chemistry. We have used economic insight, including the key role of duality, to analyse this equation.

Finally, I am also continuing my work on implied volatility modelling. A new result is that implied volatility can be computed in a reasonably explicit way, transforming formulae that were previously known to hold asymptotically into bounds which can be shown to hold uniformly.

Since the beginning of my CERF fellowship, the following papers have been submitted for publication:

Arbitrage theory without a numeraire. Available at http://arxiv.org/abs/1410.2976

Polynomial term structure models. (with S. Cheng) Available at http://arxiv.org/abs/1504.03238

An equilibrium model of market efficiency with Bayesian learning: Explicit modes of convergence to rational expectations equilibrium in the presence of noise traders (with O. Ross and S. Satchell) Available at http://ssrn.com/abstract=2545031

If B and $f(B)$ are Brownian motions, then f is affine. Available at http://arxiv.org/abs/1307.3155. To appear in the *Rocky Mountain Journal of Mathematics.*

The following papers are under preparation and to be submitted within the next few months.

A spectral interest rate model. (with S. Cheng)

Optimisation problems for the FKPP equation. (with D. Driver)

I have also presented my work on the following occasions:

TMU Finance Workshop 2014, Tokyo, November 2014

University of Michigan Financial/Actuarial Mathematics Seminar, September 2014

Tenth Cambridge-Princeton Conference, Cambridge, October 2014

Stochastic Analysis for Risk Modeling, Luminy, France, September 2014

Conference on Stochastic Calculus, Martingales and Financial Modeling, St Petersburg, June 2014

Labex Louis Bachelier - SIAM-SMAI Conference on Financial Mathematics, Paris, June 2014

Advanced Methods in Mathematical Finance, Angers, France, September 2015