Project Update – Michael Tehranchi

I have been working on a certain framework for modelling the implied volatility surface. This framework is in the spirit of the Gatheral SVI parametrisation, but is based on a novel observation about the structure of call prices. The key ingredient of my parametrisation is a log-concave density, where the standard normal density recovers the Black—Scholes model. I have recently found a family of densities where all of the relevant calculations (for instance, the shape of the implied volatility for extreme strikes) can be done rather explicitly, yet calibrate very well to the implied volatility surface of S&P call options.

In another project, a former PhD student (Si Cheng) and I developed a certain framework for modelling the interest rate term structure. This framework is rather tractable, as the prices of bonds can be expressed as a polynomial of a state variable. For our method to work, we had to make the somewhat restrictive assumption that state variable evolved as a continuous diffusion. A current PhD student (Thomas Du Toit) and I are working on lifting this assumption, extending the polynomial term structure modelling framework to include more general state variable dynamics such as jump-diffusions.

The following papers have been submitted and are currently under review:

A Black-Scholes inequality: applications and generalisation. Available at http://arxiv.org/abs/1701.03897 (a second revision has been submitted to *Finance & Stochastics)*

Optimisation-based representations for a class of reaction-diffusion equations. (with D. Driver) Available at http://arxiv.org/abs/1803.09688 (under review with *The Journal of Functional Analysis*)

I have been invited to present my research at the following conferences:

Advanced Methods in Mathematical Finance. Angers, France. August 2018.

Workshop on Stochastic Dynamical Systems and Ergodicity. Loughborough. July 2018.

Stochastic Finance Seminar. University of Warwick. January 2019

Third International Congress on Actuarial Science and Quantitative Finance. Manizales, Colombia. June 2019