ANTONY WARE, University of Calgary

Multi-factor polynomial models for energy commodity markets

In the context of energy commodity price modelling, prices are often formed from exponential maps of underlying factor processes, motivated in part by the mathematical convenience this offers. In this talk we will focus on multi-factor models based on polynomial maps of polynomial processes (PMPP models), and explore how they can function in a similar way, retaining much of the mathematical convenience of the exponential map, and providing additional flexibility, such as the ability to capture negative prices in a natural way, or to model prices with intrinsic upper bounds. And this additional level of flexibility means that PMPP models are capable of capturing the extreme dynamics that are commonly seen in energy market prices even with relatively tame dynamics in the underlying factor process.

Polynomial processes have the property that the expectation of a polynomial map of the process value at a future time T, conditional on its value at an earlier time t, is also a polynomial map of the same (or lower) degree. In the context of PMPP models, this property means that futures prices can be computed via multiplication by a (typically small) matrix. We will demonstrate how this works in practice, and show how option prices can also be computed in semi-closed form, using techniques that open the door to other applications.