Forum 1 (Hybrid)

(4th November, Friday)

3 pm - 3.30 pm (Zoom)

Yuliya Mishura (Taras Shevchenko National University of Kyiv, Ukraine)

Title: Statistical Estimation in the Models with Memory
Abstract: We investigate the mixed fractional Brownian motion with trend, driven by a standard Brownian motion and a fractional Brownian motion. We develop and compare two approaches to estimation of all unknown parameters by discrete observations. Also, we consider the model with trend and two fractional Brownian motions with different Hurst indices.

3.35 pm - 4.05 pm

Kostiantyn Ralchenko (Taras Shevchenko National University of Kyiv, Ukraine)

Title: Drift Parameter Estimation in Cox–Ingersoll– Ross Model
Abstract: The talk is devoted to the drift parameters estimation in the Cox–Ingersoll–Ross model. We prove the strong consistency of the maximum likelihood estimators based on the continuous-time observations and obtain their rate of convergence in probability. Then we introduce the discrete versions of these estimators and investigate their asymptotic behavior. In particular we establish the conditions for weak and strong consistency, asymptotic normality and get the rate of convergence in probability. The estimation quality is illustrated by simulation results.

4.10 pm - 4.40 pm (Zoom)

Anton Yurchenko - Tytorenko (University of Oslo, Norway)

Title: Volterra Sandwiched Volatility model
Abstract: We introduce a new model of financial market with stochastic volatility driven by an arbitrary Hölder continuous Gaussian Volterra process. The distinguishing feature of the model is the form of the volatility equation which ensures the solution to be "sandwiched" between two arbitrary Hölder continuous functions chosen in advance. We discuss the structure of local martingale measures on this market, investigate integrability and Malliavin differentiability of prices and volatilities as well as study absolute continuity of the corresponding probability laws. Additionally, we utilize Malliavin calculus to develop an algorithm of pricing options with discontinuous payoffs.

4.45 pm - 5 pm

Peilun He (Macquarie University)

Title: Multi-Factor Polynomial Diffusion Models and Inter-Temporal Futures Dynamics in Energy Markets

Abstract: In stochastic multi-factor commodity models, it is often the case that futures prices are explained by two latent state variables which are used to represent

the short and long term stochastic dynamic factors for modelling of commodity future term structure dynamics. These two factors are often modelled as Ornstein-Uhlenbeck (OU) processes with their linear combination assumed to be the logarithm of commodity spot price. In this work we focus on development of the family of stochastic models based on polynomial diffusion structures to represent the underlying spot price stochastic dynamics. The polynomial family of diffusion models allows one to incorporate a variety of non-linear higher order effects into a multi-factor stochastic model as well as interaction terms between stochastic variables, volatility dynamics and non-linear trend dynamics. We will compare the predictive performances of the polynomial diffusion models and the Schwartz and Smith two-factor model. The risk neutral prices of the futures contracts in the Schwartz and Smith model are given in the exponential affine closed form. However, in the case of polynomial diffusion structures, one must work with the spectral pricing representation based on the infinitesimal generator of the process. The consequence of this is that in deriving the risk neutral Futures prices, one must carefully accommodate the matrix exponent of the infinitesimal generator, unlike the Schwartz and Smith's model, where calibration and estimation are performed routinely by classical methods based on the Kalman Filter (KF) and marginal likelihood estimation. In the polynomial diffusion setting we must extend these estimation methods to be able to estimate the unknown model parameters jointly with hidden state variables under a non-linear model dynamics with measurement equations given in non-closed form. We explore numerous methods to accurately and efficiently evaluate the matrix exponentiation when utilised in filtering and calibration of these polynomial diffusion models. Finally, we illustrate the performance of these models on TOCOM Platts Dubai crude oil futures providing both, the insample and out-of-sample, RMSE for the classical two-factor models and the polynomial diffusion model extensions. The results demonstrate that the polynomial diffusion model extensions can be advantageous for explaining the inter-temporal futures dynamics more accurately.

This talk is based on the joint work with P. Schevchenko (MQU), N. Kordzakhia (MQU) and G. Peters (UCSB).

5.05 pm - 5.20 pm

Jun Han (Macquarie University) (Zoom)

Title: On Correlated Measurement Errors in the Schwartz-Smith Two-Factor Model
Abstract: The Schwartz-Smith's two-factor model is commonly used for the pricing of derivatives in commodity markets. For estimating and forecasting the term structures of futures prices, the logarithm of commodity spot price is represented as the sum of short and long-term factors being the unobservable state variables. The futures prices derived as functions of the spot price lead to the simultaneous set of the measurement equations which is used for joint estimation of the unobservable state variables and the model parameters through filtering procedure. We propose a modified model when the error terms in the measurement equations are assumed to be serially correlated. In addition, for comparative analysis, the modelling of the logarithmic returns of futures prices will also be considered. Out-of-sample prediction performances of two proposed models versus extended Schwartz-Smith (2000) model were illustrated using European Unit Allowances (EUA) futures prices from January 2017 to April 2021, and using UK Allowances (UKA) futures prices from May 2021 to March 2022.

This talk is based on the joint paper with N. Kordzakhia (MQU), P. Schevchenko (MQU) and S. Trueck (MQU).