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EDUCATION

Ph.D., Economics, Boston University, Boston MA, May 2020 (expected)
Dissertation Title: *Essays on nonlinear and non-Gaussian filtering and its application in finance*
Main advisor: Zhongjun Qu
Dissertation Committee: Zhongjun Qu, Pierre Perron and Jean-Jacques Forneron

M.S., Economics, University of Wisconsin, Madison, WI, 2013

M.A., Economics, Hitotsubashi University, Tokyo, JAPAN, 2010

B.A., Japanese, Xi'an International Studies University, Xi'an, CHINA, 2008

FIELDS OF INTEREST

Financial Econometrics, Time Series Econometrics, Computational Finance

WORKING PAPERS

"Quasi Monte Carlo Kalman Filter for Nonlinear and Non-Gaussian State Space Models," Job Market Paper, September 2019.
"Maximum Likelihood Estimation and Inference of Continuous Time Regime Switching Models: with Application on Treasury Bill Rates Data," (with Anlong Qin and Li Chen), October 2019.
"Pairs Trading: with a Nonlinear and Non-Gaussian State Space Model," September 2019.
"Hermite Polynomial Based Valuation of American Options with General Jump-Diffusion Process," (with Li Chen), September 2019.

WORK IN PROGRESS

"Pricing of American Option under Stochastic Volatility Models Based on Unscented Kalman filter"
"A *k*-means Clustering Estimator for Nonparametric GARCH Models"
"A Continuous Time GARCH (1,1) Model with Regime Switching: Formulation and Estimation" (with Li Chen)

FELLOWSHIPS AND AWARDS

Dean's Fellowship and Teaching Fellowship, BU, 2015-2019

WORK EXPERIENCE

Research Assistant, Department of Economics, Boston University, Fall 2017- Spring 2019

TEACHING EXPERIENCE

Teaching Assistant, Department of Economics, BU

EC303/304 Empirical Economic Analysis (BA level), Spring 2017, Fall 2019

EC203/204 Empirical Economics (BA level), Fall 2016

LANGUAGES

Native in Mandarin, Fluent in English and Japanese

COMPUTER SKILLS: R, Python, STATA, MATLAB, LaTeX

CITIZENSHIP/VISA STATUS: China/F1

REFERENCES

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GUANG ZHANG

Quasi Monte Carlo Kalman Filter for Nonlinear and Non-Gaussian State Space Models (Job Market Paper)

In this paper, we propose a new approach, Quasi Monte Carlo Kalman filter, to nonlinear and non-Gaussian models. QMCKF inherits the "predict step" and "update step" from Kalman filter, and applies Quasi Monte Carlo approach to compute the posteriori distribution. Quasi Monte Carlo is an efficient method for numerical integration using low-discrepancy sequences, such as the Halton sequence and the Sobol' sequence. In addition, Gaussian mixture is suggested to approximate the distribution of non-Gaussian noises and this can heavily simplify the computation of the posteriori distribution and achieve a faster rate of convergence.

Maximum Likelihood Estimation and Inference of Continuous Time Regime Switching Models: with Application on Treasury Bill Rates Data *(with Anlong Qin and Li Chen)*

In this paper, we provide a likelihood-based method for the estimation and inference of continuous time regime switching models. A continuous time regime switching model consists of a jump-diffusion process such that the parameters in the process are state dependent. The state follows a continuous time Markov chain. We approximate the transition kernel of the model based on Hermite polynomials and derive the likelihood associated with the parameter. Asymptotic properties of this MLE is also discussed in this paper for inference. In addition, we apply this approach to Treasury bill rates data and compare the filtered state with NBER recession dates.

Pairs Trading: with a Nonlinear and Non-Gaussian State Space Model

In this paper, we model the spread between the prices of two assets as an unobservable state variable and assume it follows a mean reverting process. This new model allows for (1) non-Gaussianity and heteroskedasticity of the noises effect the spread; (2) nonlinear mean-reversion of the spread. We then use filtered spread as the trading indicator for statistical arbitrage. To improve the performance, we also propose a new trading strategy and present a simulation-based approach for the selection of optimal trading rules. We implement this trading approach to two examples: PEP vs KO and EWT vs EWH, and our empirical results show we can achieve 21.86% annualized return for the PEP/KO pair and 31.84% annualized return for the EWT/EWH pair.

Hermite Polynomial Based Valuation of American Options with General Jump-Diffusion Process *(with Li Chen)*

We present a numerical scheme with proof of convergence for the approximation of the price and exercise policy of American options. The scheme is based on Hermite polynomials expansions of the transition density of the underlying asset dynamics and the early exercise premium representation of American option. Our approach, shown to be fast and accurate, does not require the transition density and characteristic functions of the underlying asset dynamics to be attainable in closed form. Our approach has a wide range of application scopes and is straightforward to implement, and could be easily extended to higher dimensional cases and jump-diffusion models.

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