The Hong Kong University of Science and Technology

Department of Mathematics

PhD THESIS EXAMINATION

Essays on the Interest Rate and Corporate Derivatives Pricing

By

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ABSTRACT

In this defense I will present three essays on the pricing of financial derivatives. Two are about the pricing of interest rate derivatives on the Secured Overnight Financing Rate (SOFR) under the affine term structure models (ATSM) and under the stochastic alpha, beta and rho (SABR) model, respectively, while one of them is about the pricing of accelerated share repurchase (ASR) contracts.

In the first essay, we propose an affine term structure model (ATSM) with scheduled jumps to capture dynamics of SOFR. We estimate a multi-dimensional Cox-Ingersoll-Ross (CIR) process using maximum likelihood and extended Kalman filter techniques, before applying the estimated model to price SOFR futures and options. In addition, we derive convexity adjustment formulas for SOFR term rates which is applied to the construction of SOFR discount curve, the essential element of inputs for SOFR derivatives pricing.

In the second essay, we develop a neural network framework to price ASR contracts that feature complex structural elements, such as daily volume constraints and client exercise features. Our adaptable framework accurately prices these features and generates effective execution and exercise strategies for intermediary banks, thus providing an efficient alternative to traditional pricing methods that rely on either Monte-Carlo simulation or PDE methods.

In the third essay, we derive the implied Black volatility for the time-inhomogeneous λ-SABR model which features mean reversion in its stochastic volatility. We propose a frozen-state-variable treatment to the existing framework of asymptotic expansion to account for the time dependence and consequently achieve notable improvements on pricing accuracy.

Date : 21 May 2026, Thursday

Time : 2:00 pm

Venue : Rm 1409 (Lifts 25/26), 1/F Academic Building, HKUST

Thesis Examination Committee:

Chairman	:	**Prof. Dimitrios PAPADIAS, CSE/HKUST**
Thesis Supervisor	:	**Prof. Lixin WU, MATH/HKUST**
Member	:	**Prof. Wei JIANG, IEDA/HKUST**
Member	:	**Prof. Shiqing LING, MATH/HKUST**
Member	:	**Prof. Can YANG, MATH/HKUST**
External Examiner	:	**Prof. Lingfei LI, Department of Systems Engineering and Engineering Management/ The Chinese University of Hong Kong** *(via online mode)*

(Open to all faculty and students)

The student's thesis is now being displayed on the reception counter in the General Administration Office (Room 3461).