WPI MATHEMATICAL SCIENCES

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PhD Candidate

Mathematical Sciences

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Olin Hall, Room 109

9:00 – 11:00am

Dissertation Committee:

Dr. Stephan Sturm, WPI (Advisor)
Dr. Agostino Capponi, Columbia University
Dr. Igor Cialenco, Illinois Institute of Technology
Dr. Randy Paffenroth, WPI
Dr. Gu Wang, WPI

PhD Dissertation Proposal Presentation

Title: In the Wake of the Financial Crisis – Regulators' and Investors' Perspectives

Abstract: Before the 2008 financial crisis, most research in the financial mathematics didn't consider the effects of counterparties' default, illiquidity problems, systemic risk and the role of the repurchase agreement (Repo). During the 2008 financial crisis, a frozen repo market led to a shutdown of short trades in the stock market. Cyclical interdependencies among corporations caused that a default of one firm seriously affected other firms and even the whole financial network.

In this thesis, we will consider financial markets which are shaped by financial crisis. This will be done from two distinct perspectives, investors' and regulators'. Recently models were proposed to compute the total valuation adjustment (XVA) of derivatives on an investor side, but these models abstract from the effects of Repo markets and their roles in different financial statuses. In our research, we introduce an alternating renewal process to describe a switching between different financial statuses. We develop a framework for pricing the XVA of a European claim in this state-dependent framework. We represent the price as a solution to a backward stochastic differential equation and prove the solution's existence and uniqueness.

To study financial networks from a regulator's perspective, the fixed-point based approach by L. Eisenberg and T. Noe became very popular. In practice, there is no accurate record of the liabilities and thus researchers have to estimate them before apply them in Eisenberg and Noe type models. In our research, we conduct a sensitivity analysis of the Eisenberg and Noe framework, and quantify the clearing payment's sensitivity to such estimation errors. We show that the effect to clearing payment can be describe via directional derivatives that can be showed as solutions of fixed point equations. We also compute the probability of observing clearing payment deviations of a certain magnitude.