MATH CCES Center for Computational Engineering Science

RWTH AACHEN UNIVERSITY

Thesis, Seminar or Project

Mean-Field Models of Financial Markets

Course of study:	Mathematics, CES, Physics, Economics, Industrial Engineers and Computer Science
Kind of Research:	Programming and mean-field modeling
Programming language:	C++, Matlab

Problem

One challenging task in economics is to explain the formation of stylized facts in financial data. Stylized facts are universal market properties, which can be observed at stock markets all over the world. One famous example are Pareto tails in income distributions and stock returns. To give an answer to this question it is necessary to have a model of financial markets.

One very popular approach is to model a financial market as a random walk model of many interacting agents. Furthermore, such econophysical models consider behavioral aspects of agents, which might play an important role in the formation of stylized facts.

From a mathematical perspective such agent based models can be described by stochastic differential equations or Boltzmann-like kinetic models. To study the long time behavior of such a system one can consider the so called mean-field limit. This mean-field limit leads in general to a partial differential equation of Fokker-Planck type.

Preliminary work

The project will be based on an existing econophysical, respectively Boltzmann-like kinetic market model.

Task

Depending on the level of knowledge and interests of the participants different paths could be followed:

- implement a Monte Carlo simulation for the Fokker-Planck equations
- implement a finite difference/ finite element solver for the Fokker-Planck equations
- implement a random walk model and possibly derive the mean-field limit
- derive the mean-field limit of a kinetic model

Supervision

This project is offered by the MathCCES research group headed by Prof. Dr. Martin Frank. The project will be supervised by

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