Syllabus

1 Contact Information

- Office Hours: 812 Uris Hall; open-door or by email
- Email: neng.wang@columbia.edu
- Course materials: Canvas and if you cannot find materials on Canvas, please email:
  - Leticia Jerman at lj2192@columbia.edu
  - Elisabeth Friedman at ev2142@columbia.edu.

2 Course Description

This course covers topics on no-arbitrage-based asset pricing (e.g. option pricing, term structure, credit risk), optimal consumption and portfolio choice, general equilibrium/asset pricing theory, and dynamic corporate finance theory using continuous-time methods. We cover both the classics and frontier research papers.

3 Readings and References

- The “textbook” (broadly interpreted) for the asset pricing part of the course is
  - Duffie, D. [2001]. Dynamic Asset Pricing Theory

Lectures will be based primarily on my notes and sometimes research articles. We will have a tentative course schedule. The exact progression of the course will depend on you. We will adapt our speed and coverage as we move forward.

- A standard reference book is
  - Merton, R. C. [1990]. Continuous Time Finance

which includes a few overview chapters and a collection of Merton’s classic articles.
• Additionally, I also recommend the following three books.
  – Dumas and Luciano’s “The Economics of Continuous-Time Finance”
  – Kerry Back’s “asset pricing and portfolio choice theory”
  – George Pennachi’s “Theory of asset pricing”
  – Steve Shreve’s “Stochastic Calculus for Finance II: Continuous-Time Models”

4 Course Requirements and Grading

Course requirements include (1) individual homework assignments and (2) a final exam and possibly a midterm exam. You may also be asked to present working papers towards the end of the semester. If so, your presentation will be counted as part of the homework assignments. Of course, class participation (broadly interpreted) is part of your course evaluation.

5 Course Outline and Readings (Tentative)

Below is a tentative schedule of topics and readings. (Papers with * are essential readings and some of them are classics.)

5.1 Brownian Motion and Stochastic Calculus

• Brownian motion and stochastic integration

• Stochastic discount factor (SDF)

• Equivalent Martingale Measure (EMM)

• SDF, EMM, and No Arbitrage

Readings:


5.2 Risk Neutral Pricing and Option Pricing

• Redundant Securities

• Complete Markets

• The Black and Scholes economy

• Pricing: The Martingale Approach

• Pricing: The PDE Approach

• Replication

• Put-Call Parity

• Stochastic Volatility and Jump Models

Readings:


5.3 Term Structure of Interest Rates

- ‘Equilibrium’ models
- Short-rate models
- Arbitrage-free models
- Affine models

Readings:


5.4 Stochastic Volatility and Jump Models
• Heston model
• Affine jump diffusion

5.5 Credit Risk Models
• “Structural” models, e.g. Merton, Leland, and etc.
• Reduced form models, affine models, doubly stochastic (Cox) models

5.6 Optimal Portfolio and Consumption Choices
• Merton’s Problem
• The Hamilton Jacobi Bellman approach (Dynamic Programming)
• The Martingale approach
• Example: Portfolio choice with margin constraints, predictability, or labor income shocks

Readings:
• Heston S. [1993]. A Closed-Form Solution for Options with Stochastic Volatility with Applications to Bond and Currency Options, Review of Financial Studies 6, 327-344.
5.7 Equilibrium

- The Lucas-Breeden Model and Consumption CAPM
- Production-based Asset Pricing
- Intertemporal CAPM
- Long-Run Risk Models (Bansal and Yaron)
- Habit Models (Campbell and Cochrane)
- Heterogeneous Agents Models

Readings:

- Bansal and Yaron (2004, JF)
- Campbell and Cochrane (1999, JPE)
5.8 Dynamic Corporate Investment

Dynamic Investment Theories

- Hayashi (1982, Econometrica) and the $q$ theory of investment
- McDonald and Siegel (1986, QJE), Dixit and Pindyck (1994) and Real options

5.9 Contingent-Claims Capital Structure Models

- More recent work on banking

5.10 Dynamic Models with Financial Constraints

- DeCamps, Mariotti, Rochet, and Villeneuve (2011 JF)

5.11 Dynamic Contracting


5.12 Financial Frictions and Macro

- Brunnermeier and Sannikov (AER)
- Krishnamurthy and He (REStud)

5.13 Dynamic Learning Models

5.14 Other Topics including Various Applications in Economics