NYU FRE Department
FRE-GY 6901: Volatility Models 1
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PRE-REQUISITES

Prerequisites: stochastic calculus and option pricing

COURSE OBJECTIVES

Volatility is the most important factor in pricing and hedging financial derivatives, as well as in measuring and managing financial risk. It is therefore very important for financial engineers to be familiar with the different notions of volatility and the different volatility products, and to accurately model the volatility of financial markets in order to (1) correctly evaluate and hedge derivative products, (2) generate realistic future scenarios in order to quantify and manage risks, and (3) predict future volatility.

At the end of the module, students will know the different types of volatility and volatility products, the most important volatility models, the reasons why those models were introduced, their properties, their advantages and flaws, and how to calibrate them to market data. They will also have implemented several models in Python (pricing, calibration).

In professional life, this module will allow students to correctly choose a volatility model depending on the problem at hand, to calibrate it to market data, and to simulate it.

This course in in two parts: Volatility Models 1 (Spring) and Volatility Models 2 (Fall). This is the course program for Volatility Models 1.

COURSE PROGRAM

- The different types of volatility
- The different types of volatility derivatives
- The volatility smile
- Static v. dynamic properties of volatility models
- Volatility modeling: a brief history
- Black-Scholes
- Local volatility
- Stochastic volatility
- Variance curve models (second generation of stochastic volatility models)

MODALITIES

6 sessions of 2h40min that mix lectures and exercises; 1 in-class final exam

COURSE ASSESSMENT AND VALIDATION REQUIREMENTS FOR STUDENTS

Class participation: 10%
Homeworks and computing assignments: 60%
In-class final exam: 30%

Bibliography and course documents

Lecture slides. References:
- Bergomi, L.: Stochastic Volatility Modeling, Chapman & Hall, 2016.
- Gatheral, J.: The Volatility Surface, A Practitioner's Guide, Wiley Finance, 2006.
- Guyon, J. and Henry-Labordère, P.: Nonlinear Option Pricing, Chapman & Hall, 2014.