Large Project 2014

This year's Large Project will be a joint project for all students participating in the course. In this project we shall extend an existing package for evaluating exotic contingent claims on the FX and equity markets. This software has to be written for an end-user who uses financial instruments in its everyday operations and is not an expert in numerical analysis and computational finance. The project will be the continuation of the project from the last year. The project is a library of functions performing different tasks. A number of functions is already available. We shall only modify some of existing functions and write few new functions.

The main task of the project is to extend the main module (main program) which manages all functions, supplies data to them, provides the communication between the functions and solves the problem of communication with an end-user interface. A large part of this module is ready but it needs some extensions.

The main module is split into two separate sub-modules: one which uses individual users accounts and performs complicated calculations with market data provided by the user as separate files, and the second one (a simple calculator) which is accessible on-line by everybody and calculate prices of simple instruments (that which possess analytic formulas for prices) after entering necessary data from keyboard. The simple calculator is in its final version. We shall extend however the real data calculator on exotic products.

The main goal of the project is to extend the real data calculator on Monte Carlo computations of exotic options on the Black-Scholes market and market with stochastic volatility. This goal should be complemented with some modifications of existing functions and writing few specific functions.

In the course of the project the following tasks are essential:

1. Extension the Monte Carlo Longstaff&Schwartz algorithm for computing prices of European and American options on the Black-Scholes market to pricing exotic barrier options with continuous, discrete and window barriers.

2. Extension the PDE Black-Scholes approach to pricing exotic Parisian barrier options.

3. Extension the Monte Carlo Longstaff&Schwartz algorithm to pricing options in stochastic volatility models: American options, barrier options.

All these modules should be implemented in a way which can be easily adapted to both FX and equity markets.

Documentation. It is absolutely essential to describe carefully the theoretical background of every function. But also the documentation of the computer code has to be provided. A particular attention should be put on the structure of the programme (block scheme), the format of input and output data, signaling choices, etc. The participants of the project should be aware that this is already a sixth year of the project development and during all previous years some part of the code was extended in subsequent years. This means that the documentation has to be detailed enough to enable the development of the existing code and not forcing new participants to write the code from the beginning.

The project will consist of the following tasks:

1. Pricing European and American exotic barrier options: Parisian options, lookback options in the Black-Scholes model applying PDE approach.

2. Pricing European and American barrier options: options with American barrier and double barrier with barrier monitored continuously, discretely and in a time window; Parisian options, lookback options in the Black-Scholes model applying Monte Carlo approach.

3. Pricing European and American vanilla and barrier options: options with American barrier and double barrier with barrier monitored continuously, discretely and in a time window; Parisian options, lookback options in stochastic volatility models applying Monte Carlo approach.

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