FE 620: Pricing and Hedging
Spring 2020: Group Project

Introduction

For your course project, you will work in small teams (of 3-4 people) to go through the process of building a pricing tool and use it for hedging and risk management (hedging) of a financial derivative. Broadly your projects will consist of three inter-related topics:

1. financial interpretation and application of derivatives;
2. valuation algorithm for pricing; and
3. data collection and analysis.

In doing this analysis you should implement models and techniques discussed in class or from *Hull* [1] on real data (from, e.g., *Yahoo Finance*).

You will get the most out of the project if you interact with the teacher and the TA during the entire duration of this project.

Important Dates

Milestone	**Data**	**Deliverables**
Team Formation	Fri 21 Feb 2020 @ 5PM	Submit as text on Canvas. One per group. Include the names for the members of the team.
Project Proposal	Fri 13 Mar 2020 @ 5PM	Submit **pdf** on Canvas. One per group.
Final Report	Fri 17 Apr 2020 @ 5PM	Submit **pdf** on Canvas. One per group.
Project Presentation	22 April 2020 [in class]	Submit **pdf** of slides on Canvas. One per group.

Project Components

Application of Derivatives

Choose a derivative from the following list. More details can be found in *Hull* [1] (Ch. 26).

- American options;
- Asian options;
- Barrier options;
- Binary or digital options;

Think about when such derivatives might be used in practice. Research the literature about your chosen derivative.

Valuation Algorithm

Use a numerical technique to price your derivative on fictitious data. Consider, for instance, Binomial Trees or Monte Carlo simulation of the Black-Scholes model. Compute valuations and sensitivities with respect to market parameters. Consider the errors produced by numerical approximations and simulations in your pricing.

Data Collection and Analysis

In this step your team will download financial data on a liquidly traded asset (equity or commodity future) and option prices from *Yahoo Finance* or other sources. You will need to estimate market parameters from financial data. Consider historical and implied volatilities, find the volatility smile, forward curve of your asset, etc... Use your valuation algorithm to price the derivative under consideration. Think about how to hedge the derivative using the underlying asset and perform a hedging analysis.

Deliverables

Deliverable #1: Team Formation

You will submit your choices for teams for projects. Teams should consist of **3-4 students**. If you have trouble forming a group for any reason (whether that means you are a single individual or have a partial group of 2 students), please submit that by the deadline. With your team submission, you ***must*** provide a proposed derivative to study.

Deliverable #2: Project Proposal

You will submit a formal proposal for your project. This should give as much detail as possible about what specifically you will consider the full breadth of your project. As part of your proposal, you **must** provide a detailed timeline detailing the activities necessary to complete your project, timelines for start and end dates of each task, and teammate assignments to each task.

Deliverable #3: Final Report

You will submit your final write-up, which should include all of the information detailed below. This should be presented in roughly the order given, but your write-up need not have corresponding sections or bullet points. The write-up should be about 15 double-spaced pages, Times New Roman 12pt font. This does not include any appendices (e.g., your *python* code) you may wish to include. Any external resources used should have clear citations and a reference page at the end of your work. The report should include an appendix describing the contributions of each team member.

1. **General description** of the derivative: payoff, rationale for trading and possible economic use.

2. Detailed description of the **pricing algorithm** chosen for the derivative considered, and sample results obtained with dummy data. This includes test results, sensitivity to inputs and parameters of the numerical algorithm (e.g. sensitivity to the choice of the time step).

3. **Data analysis**: explain the financial data used, and the details and results of the analysis performed. Mention any data cleaning if required.

4. The results obtained by running the pricing algorithm for the **derivative using real data** as inputs.

5. **Hedging analysis**: principle and test results. What are the main risks of the derivative, and how can they be hedged?

6. **Next steps**: What else could be done with the data collected and pricing algorithm, but time did not permit?

Project Presentation

On the last day of class, your group will give a 10 minute prepared presentation. Every team member should present on their contributions to the work. An additional 2-3 minutes will be used for questions. Order of presentations will be settled the week before and may be either random or based on a sign-up sheet on first-come first-serve basis [TBD].

References

[1] John C. Hull, Options, Futures and Other Derivatives, Pearson, 10th Edition, 2018