
Introduction to Financial Engineering (HW3)

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- Please follow the guidelines for assignments given in the Module Handbook.
 - All programs should be written in R (compilable without errors or warnings).
 - You should submit a write-up (.pdf) of the program as well as the source code (.r).
 - File names should be as yoursurname_yourname_HW3.extension
 - You should submit via moddle.
 - Deadline: 3rd November 2023 at 10am.
1. Complete the following questionnaire for each of the option strategies (there are 7 different strategies) (all strategies have the same expiry and are written on the same underlying, consider the spot price to be 100):
- (a) Write down the payoff function in formulas (without premiums).
 - (b) Plot the payoff function without premiums (show in different colours the building blocks of the strategy and the aggregated result).
 - (c) Investigate and explain in your own words the financial rationale of the strategy.
 - (d) Plot a profit diagram for arbitrary premiums (although arbitrary, premium must fulfil the right order and magnitude between them).

Notation: When written X Call (respectively X Put), it means a Call with strike X (respectively a Put with strike X), for example a 120 Call means a Call option with strike 120. Being long an asset means having it and being short an asset means the sell of the stock.

- **Bull and Bear Spreads**
 - Bull Spread: Buy a 100 Call option and sell a 120 Call option.
 - Bear Spread: Sell a 100 Put option and buy a 120 Put option.
 - **Covered Call and Puts**
 - Covered Call: Assume being long on the underlying stock, then sell a 110 Call.
 - Covered Put: Assume being short on the underlying stock, then sell a 90 Put.
 - **Collar**: Assume being long on the underlying stock, then sell a 110 Call option and buy a 90 Put option.
 - **Butterflies and Condors**
 - Butterflies: Buy a 90 Call, sell two 100 Call and buy a 110 Call.
 - Condors: Buy a 90 Call, sell 100 Call, sell 110 Call and buy a 120 Call.
2. A stock currently trades at \$60. A Call with strike price \$58 and expiry 12 months trades at \$3; a Put with the same strike and expiry trades at \$2. The interest rate at 12 months is 10%.
- Do any arbitrage opportunities exist?
 - If there is a possible arbitrage, then explain the strategy to get profit from it.

(Hint: This is an application of the put-call parity).