

TIØ4140 Project Evaluation and Financing
Exercise 1: Introduction to Derivatives, Insurance Strategies, and Risk Management

Posted: Monday 13, 2025, Morning.

Submission deadline: Tuesday, January 28, 2024, 23:59.

Grading: Approved / Not approved.

N.B.:

- *To get “Approved”, you should attempt to solve all mandatory tasks and have 70% correct.*
 - *Remember to write down the **main solution steps**!*
-

Overview of Tasks

- **Task 1:** The following problems from McDonald (2013):
 - **Ch. 1** Introduction to Derivatives 7
 - **Ch. 3** An Introduction to Forwards and Options 14
 - **Ch. 4** Insurance, Collars, and Other Strategies 19
 - Exam problem
- **Voluntary Task:**
 - **Ch. 5** Introduction to Risk Management Derivatives 10

Mandatory tasks

Problems from McDonald (2013)

Chapter 1: Introduction to Derivatives

- 1.7.** Suppose you desire to short-sell 400 shares of JKI stock, which has a bid price of \$25.12 and an ask price of \$25.31. You cover the short position 180 days later when the bid price is \$22.87 and the ask price is \$23.06.
- a. Taking into account only the bid and ask prices (ignoring commissions and interest), what profit did you earn?
 - b. Suppose that there is a 0.3% commission to engage in the short-sale (this is the commission to sell the stock) and a 0.3% commission to close the short-sale (this is the commission to buy the stock back). How do these commissions change the profit in the previous answer?
 - c. Suppose the 6-month interest rate is 3% and that you are paid nothing on the short-sale proceeds. How much interest do you lose during the 6 months in which you have the short position? You can choose to calculate this with or without fees.

Chapter 3: An Introduction to Forwards and Options

3.14. Innovex Corp is a tech company known for its innovative products launched at the market recently. Potential investors are closely watching its stock, which is currently trading at \$42. The effective annual interest rate is 7%¹.

As part of your role as a financial analyst, you are tasked with analysing the potential risks and rewards of put options on Innovex Corp stock. In particular, you are asked to:

- a. Draw the **payoff** and **profit diagrams** for the following put options on Innovex Corp stock:
 - A 38-strike put with a premium of **\$1.72**.

¹ Note: if the “effective annual interest rate” is r , a \$1 investment yields $1 + r$ after 1 year.

- A 42-strike put with a premium of **\$3.54**.
- A 46-strike put with a premium of **\$6.10**

b. Compare your results. Why do you think the option premium should increase with the strike price?

Chapter 4: Insurance, Collars, and Other Strategies

4.19. Here is a quote from an investment website about an investment strategy using options:

One strategy investors are applying to the XYZ options is using “synthetic stock.” A synthetic stock is created when an investor simultaneously purchases a call option and sells a put option on the same stock. The end result is that the synthetic stock has the same value, in terms of capital gain potential, as the underlying stock itself. Provided the premiums on the options are the same, they cancel each other out so the transaction fees are a wash.

Suppose, to be concrete, that the premium on the call you buy is the same as the premium on the put you sell, and both have the same strikes and times to expiration.

- What can you say about the strike price?
- What term best describes the position you have created?
- Suppose the options have a bid-ask spread. If you are creating a synthetic purchased stock and the net premium is zero inclusive of the bid-ask spread, where will the strike price be relative to the forward price?
- If you create a synthetic short stock with zero premium inclusive of the bid-ask spread, where will the strike price be relative to the forward price?
- Do you consider the “transaction fees” to really be “a wash”? Why or why not?

Exam problem

A stock price is currently \$50. Over the next two 3-month periods, it is expected to go up by 6% or down by 5%. The risk-free interest rate is 5% per annum with continuous compounding.

- What is the value of a 6-month European call option with a strike price of \$51?
- What is the value of a 6-month European put option with a strike price of \$51?
- Verify that the European call and European put prices satisfy call-put parity.

Voluntary Task

Chapter 5: Introduction to Risk Management

For the following problem consider the following situation for the firm Telco. Telco installs telecommunications equipment and uses copper wire as an input. Wires use one pound of copper per unit and have a cost of \$5 plus the price of copper. For planning purposes, Telco assigns a fixed revenue of \$6.20 for each unit of wire it uses.

The 1-year forward price of copper is \$1 per pound. The 1-year continuously compounded interest rate is 6%. One-year option prices for copper are shown in the table below.

Strike (\$)	Call (\$)	Put (\$)
0.9500	0.0649	0.0178
0.9750	0.0500	0.0265
1.0000	0.0376	0.0376
1.0250	0.0274	0.0509
1.0340	0.0243	0.0563
1.0500	0.0194	0.0665

In your answers, at a minimum consider copper prices in 1 year of \$0.80, \$0.90, \$1.00, \$1.10, and \$1.20.

5.10. Compute estimated profit in 1 year if Telco sells collars with the following strikes:

- a. \$0.95 for the put and \$1.00 for the call.
- b. \$0.975 for the put and \$1.025 for the call.
- c. \$0.95 for the put and \$0.95 for the call.

Draw a graph of the profit in each case.

References

McDonald, R. L. (2013). *Derivatives markets*. 3rd. ed., New International Edition. Pearson Education.