King Saud University

Department of Mathematics

Tutorial 1

ACTU 473 – Models of Financial Economics

Exercise 1.

For a stock, you are given:

(i) The current price of the stock is 50.
(ii) At the end of 3 months, the stock price will be either 45 or 55
(iii) The stock pays dividends at a rate proportional to its price. The dividend yield is 3%.
(iv) The continuously compounded risk-free interest rate is 4%.

Consider a 3-month 53-strike European put on the stock.

(a) Construct a replicating portfolio of the put option.
(b) Calculate the time-0 price of the put option.
(c) Suppose that the market price of the put is 4.60, describe an arbitrage opportunity and find the arbitrage profit.

Exercise 2.

For a non-dividend paying stock, you are given:

i. The current price of the stock is 40.
ii. At the end of 1 month, the stock price will be either 42 or 38
iii. The continuously compounded risk-free interest rate is 8%.

(a) Calculate the current price of a 1 -month 39-strike European call.
(b) Identify an arbitrage strategy if the market price of the option is 1.5

Exercise 3.

For a non-dividend paying stock, you are given:

(i) The current stock price is 100
(ii) It is known that at the end of 1 year, the stock price will be either $100u$ or 92
(iii) The continuously compounded risk-free interest rate is 5%
(iv) The price of a 1-year at- the- money European call option on the stock is 1.78

Calculate u

Exercise 4.

For a non-dividend paying stock, you are given:

(i) The current stock price is 100
(ii) It is known that at the end of 1 year, the stock price will be either 105 or 95.
(iii) The continuously compounded risk-free interest rate is 3%.

(a) Calculate the risk-neutral probability of an increase in stock price in one year.
(b) Calculate the time-0 price of a -year at-the-money European call on the stock.

Exercise 5.

For a stock, you are given:

(i) The current stock price is 100
(ii) It is known that at the end of 1 year, the stock price will be either 90 or 110.
(iii) The stock pays dividends at a rate proportional to its price. The dividend yield is 5%.
(iv) The continuously compounded risk-free interest rate is 6%.

(a) Calculate the price of a 1 -year 105-strike European call on the stock.
(b) Calculate the price of a 1 -year 105-strike European put on the stock.
(c) Show that the prices you found in (a) and (b) satisfy the put-call parity.

Exercise 6.

For a 1-year strangle on a non-dividend paying stock, you are given:

(i) The strangle can only be exercised at the end of one year.
(ii) Let $S(1)$ be the stock price at the end of one year. The payoff of the straddle is as follows:

Stock Price	**Payoff**
$S(1) \leq 60$	$60 - S(1)$
$60 < S(`1) < 70$	0
$S(1) \geq 70$	$S(1) - 70$

(iii) The stock currently sells for 60.
(iv) The continuously compounded risk-free interest rate is 8%
(v) In one year, the stock will either sell for 75 or 45

Calculate the current price of the strangle.

Exercise 7.

For a 6-month butterfly spread on a stock, you are given:

(i) The butterfly spread can only be exercised at the end of 6 month.
(ii) Let $S(0.5)$ be the stock price at the end of 6 months. The payoff from the butterfly spread is as follows:

Stock Price	**Payoff**
$S(0.5) \leq 80$	0
$80 \leq S(0.5) < 100$	$S(0.5) - 80$
$100 \leq S(0.5) < 120$	$120 - S(0.5)$
$S(0.5) \geq 120$	0

(iii) The stock currently sells for 100.
(iv) The continuously compounded risk-free interest rate is 5%.
(v) In 6 months, the stock will either sell for 90 or 110.
(vi) The stock pays dividends at a rate proportional to its price. The dividend yield is δ.

Calculate the current price of the butterfly spread.