Chapter 9

Mechanics of Options Markets

Practice Questions

Problem 9.8
Explain why an American option is always worth at least as much as a European option on the same asset with the same strike price and exercise date.

The holder of an American option has all the same rights as the holder of a European option and more. It must therefore be worth at least as much. If it were not, an arbitrageur could short the European option and take a long position in the American option.

Problem 9.9
Explain why an American option is always worth at least as much as its intrinsic value.

The holder of an American option has the right to exercise it immediately. The American option must therefore be worth at least as much as its intrinsic value. If it were not an arbitrageur could lock in a sure profit by buying the option and exercising it immediately.

Problem 9.11
Suppose that a European call option to buy a share of Rio Tinto for AUD 100.00 costs AUD 5.00 and is held until maturity. Under what circumstances will the holder of the option make a profit? Under what circumstances will the option be exercised? Draw a diagram illustrating how the profit from a long position in the option depends on the stock price at maturity of the option.

Ignoring the time value of money, the holder of the option will make a profit if the Rio Tinto stock price at maturity of the option is greater than AUD 105. This is because the payoff to the holder of the option is, in these circumstances, greater than the AUD 5 paid for the option. The option will be exercised if the Rio Tinto stock price at maturity is greater than AUD 100. Note that if the stock price is between AUD 100 and AUD 105 the option is exercised, but the holder of the option takes a loss overall. The profit from a long position is as shown in Figure S9.1.

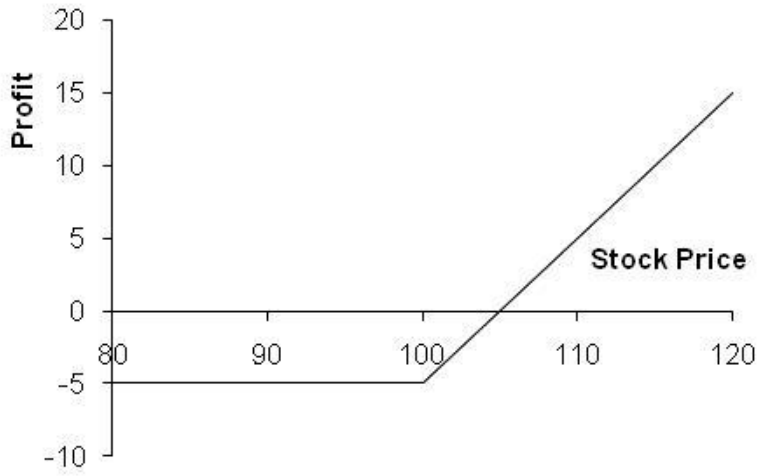

Figure S9.1: Profit from long position in Problem 9.11

Problem 9.12
Suppose that a European put option to sell a share of BHP for AUD 60 costs AUD 8 and is held until maturity. Under what circumstances will the seller of the option (the party with the short position) make a profit? Under what circumstances will the option be exercised? Draw a diagram illustrating how the profit from a short position in the option depends on the stock price at maturity of the option.

Ignoring the time value of money, the seller of the option will make a profit if the BHP stock price at maturity is greater than AUD 52.00. This is because the cost to the seller of the option is in these circumstances less than the price received for the option. The option will be exercised if the BHP stock price at maturity is less than AUD 60.00. Note that if the stock price is between AUD 52.00 and AUD 60.00 the seller of the option makes a profit even though the option is exercised. The profit from the short position is as shown in Figure S9.2.

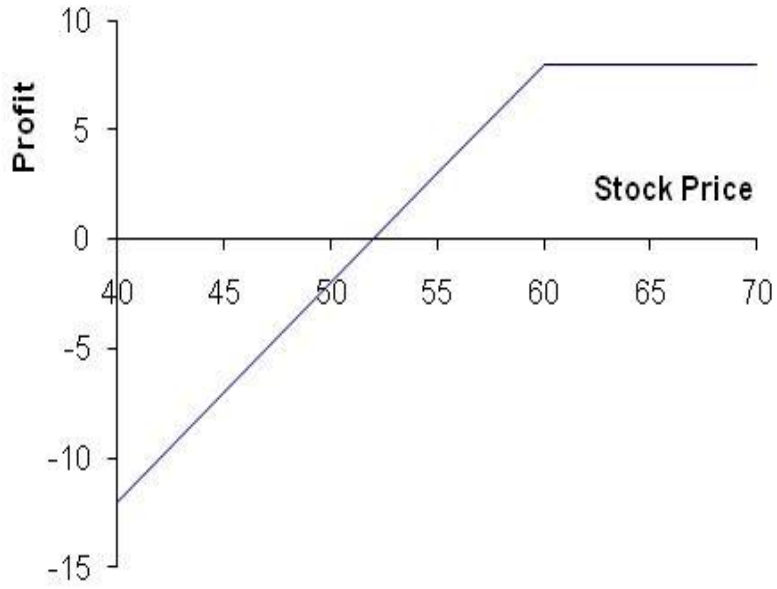

Figure S9.2: Profit from short position in Problem 9.12

Problem 9.13
A trader buys a call option to buy a share of BHP with a strike price of AUD 45 and a put option to sell a share of BHP with a strike price of AUD 40. Both options have the same maturity. The call costs AUD 3 and the put costs AUD 4. Draw a diagram showing the variation of the trader's profit with the BHP stock price.

Figure S9.3 shows the variation of the trader's position with the BHP stock price.

We can divide the alternative asset prices into three ranges:

a) When the BHP stock price is less than AUD 40, the put option provides a payoff of $40-S_T$ and the call option provides no payoff. The options cost AUD 7 and so the total profit is $33-S_T$.
b) When the BHP stock price is between AUD 40 and AUD 45, neither option provides a payoff. There is a net loss of AUD 7.
c) When the BHP stock price is greater than AUD 45, the call option provides a payoff of S_T-45 and the put option provides no payoff. Taking into account the AUD 7 cost of the options, the total profit is S_T-52.

The trader makes a profit (ignoring the time value of money) if the stock price is less than AUD 33 or greater than AUD 52. This type of trading strategy is known as a strangle and is discussed in Chapter 11.

Problem 9.18
The treasurer of a corporation is trying to choose between options and forward contracts to hedge the corporation's foreign exchange risk. Discuss the advantages and disadvantages of each.

Forward contracts lock in the exchange rate that will apply to a particular transaction in the future. Options provide insurance that the exchange rate will not be worse than some level. The advantage of a forward contract is that uncertainty is eliminated as far as possible. The disadvantage is that the outcome with hedging can be significantly worse than the outcome with no hedging. This disadvantage is not as marked with options. However, unlike forward contracts, options involve an up-front cost.