

option writer *p.* 707
 out-of-the-money *p.* 709
 portfolio insurance *p.* 717
 protective put *p.* 717
 put-call parity *p.* 719
 put option *p.* 707

speculate *p.* 709
 straddle *p.* 716
 strangle *p.* 716
 strike (exercise) price *p.* 707
 time value *p.* 721

Further Reading

For a deeper discussion of options and other derivative securities, see the following books: R. McDonald, *Derivative Markets* (Prentice Hall, 2009), and J. Hull, *Options, Futures, and Other Derivatives* (Prentice Hall, 2011).

Problems

All problems are available in [MyFinanceLab](#). An asterisk (*) indicates problems with a higher level of difficulty.

Option Basics

- Explain the meanings of the following financial terms:
 - Option
 - Expiration date
 - Strike price
 - Call
 - Put
- What is the difference between a European option and an American option? Are European options available exclusively in Europe and American options available exclusively in the United States?
- Below is an option quote on IBM from the CBOE Web site showing options expiring in September and October 2012.
 - Which option contract had the most trades today?
 - Which option contract is being held the most overall?
 - Suppose you purchase one option with symbol IBM1222I210-E. How much will you need to pay your broker for the option (ignoring commissions)?
 - Explain why the last sale price is not always between the bid and ask prices.
 - Suppose you sell one option with symbol IBM1222I210-E. How much will you receive for the option (ignoring commissions)?
 - The calls with which strike prices are currently in-the-money? Which puts are in-the-money?
 - What is the difference between the option with symbol IBM1222I200-E and the option with symbol IBM1220J200-E?
 - On what date does the option with symbol IBM1222U200-E expire? In what range must IBM's stock price be at expiration for this option to be valuable?

IBM (INTL BUSINESS MACHINES)

Sep 13 2012 @ 16:18 ET

Bid 205.29

Ask 206.30

Size 1 × 1

206.36 2.59

Vol 3879539

Calls	Last Sale	Net	Bid	Ask	Vol	Open Int	Puts	Last Sale	Net	Bid	Ask	Vol	Open Int
12 Sep 200.00 (IBM1222I200-E)	6.26	1.96	6.45	6.65	193	6898	12 Sep 200.00 (IBM1222U200-E)	0.23	-0.42	0.19	0.22	946	3351
12 Sep 205.00 (IBM1222I205-E)	2.35	1.14	2.36	2.49	1800	7390	12 Sep 205.00 (IBM1222U205-E)	1.10	-1.35	1.03	1.10	592	1184
12 Sep 210.00 (IBM1222I210-E)	0.32	0.15	0.36	0.42	508	2818	12 Sep 210.00 (IBM1222U210-E)	4.15	-2.50	3.95	4.15	118	625
12 Sep 215.00 (IBM1222I215-E)	0.06	0.03	0.04	0.08	36	1010	12 Sep 215.00 (IBM1222U215-E)	18.20	pc	8.60	8.95	0	36
12 Oct 200.00 (IBM1220J200-E)	8.20	1.53	8.30	8.45	242	5786	12 Oct 200.00 (IBM1220V200-E)	2.04	-0.88	1.98	2.05	150	2646
12 Oct 205.00 (IBM1220J205-E)	4.85	1.05	4.90	5.00	382	8141	12 Oct 205.00 (IBM1220V205-E)	3.50	-1.31	3.55	3.65	211	1335
12 Oct 210.00 (IBM1220J210-E)	2.36	0.58	2.45	2.54	186	7074	12 Oct 210.00 (IBM1220V210-E)	6.37	-1.54	6.05	6.20	35	1234
12 Oct 215.00 (IBM1220J215-E)	1.11	0.36	1.04	1.10	115	3983	12 Oct 215.00 (IBM1220V215-E)	10.80	-9.90	9.65	9.75	5	238

Source: Chicago Board Options Exchange at www.cboe.com

Option Payoffs at Expiration

4. Explain the difference between a long position in a put and a short position in a call.
5. Which of the following positions benefit if the stock price increases?
 - a. Long position in a call
 - b. Short position in a call
 - c. Long position in a put
 - d. Short position in a put
-  6. You own a call option on Intuit stock with a strike price of \$40. The option will expire in exactly three months' time.
 - a. If the stock is trading at \$55 in three months, what will be the payoff of the call?
 - b. If the stock is trading at \$35 in three months, what will be the payoff of the call?
 - c. Draw a payoff diagram showing the value of the call at expiration as a function of the stock price at expiration.
-  7. Assume that you have shorted the call option in Problem 6.
 - a. If the stock is trading at \$55 in three months, what will you owe?
 - b. If the stock is trading at \$35 in three months, what will you owe?
 - c. Draw a payoff diagram showing the amount you owe at expiration as a function of the stock price at expiration.
-  8. You own a put option on Ford stock with a strike price of \$10. The option will expire in exactly six months' time.
 - a. If the stock is trading at \$8 in six months, what will be the payoff of the put?
 - b. If the stock is trading at \$23 in six months, what will be the payoff of the put?
 - c. Draw a payoff diagram showing the value of the put at expiration as a function of the stock price at expiration.
-  9. Assume that you have shorted the put option in Problem 8.
 - a. If the stock is trading at \$8 in three months, what will you owe?
 - b. If the stock is trading at \$23 in three months, what will you owe?
 - c. Draw a payoff diagram showing the amount you owe at expiration as a function of the stock price at expiration.
10. What position has more downside exposure: a short position in a call or a short position in a put? That is, in the worst case, in which of these two positions would your losses be greater?
11. Consider the September 2012 IBM call and put options in Problem 3. Ignoring any interest you might earn over the remaining few days' life of the options:
 - a. Compute the break-even IBM stock price for each option (i.e., the stock price at which your total profit from buying and then exercising the option would be zero).
 - b. Which call option is most likely to have a return of -100% ?
 - c. If IBM's stock price is \$216 on the expiration day, which option will have the highest return?
12. You are long both a call and a put on the same share of stock with the same exercise date. The exercise price of the call is \$40 and the exercise price of the put is \$45. Plot the value of this combination as a function of the stock price on the exercise date.
13. You are long two calls on the same share of stock with the same exercise date. The exercise price of the first call is \$40 and the exercise price of the second call is \$60. In addition, you are short two otherwise identical calls, both with an exercise price of \$50. Plot the value of this combination as a function of the stock price on the exercise date. What is the name of this combination of options?
- *14. A forward contract is a contract to purchase an asset at a fixed price on a particular date in the future. Both parties are obligated to fulfill the contract. Explain how to construct a forward contract on a share of stock from a position in options.

15. You own a share of Costco stock. You are worried that its price will fall and would like to insure yourself against this possibility. How can you purchase insurance against this possibility?
16. It is September 13, 2012, and you own IBM stock. You would like to insure that the value of your holdings will not fall significantly. Using the data in Problem 3, and expressing your answer in terms of a percentage of the current value of your portfolio:
 - a. What will it cost to insure that the value of your holdings will not fall below \$200 per share between now and the third Friday in September?
 - b. What will it cost to insure that the value of your holdings will not fall below \$200 per share between now and the third Friday in October?
 - c. What will it cost to insure that the value of your holdings will not fall below \$205 per share between now and the third Friday in October?

Put-Call Parity

17. Dynamic Energy Systems stock is currently trading for \$33 per share. The stock pays no dividends. A one-year European put option on Dynamic with a strike price of \$35 is currently trading for \$2.10. If the risk-free interest rate is 10% per year, what is the price of a one-year European call option on Dynamic with a strike price of \$35?
18. You happen to be checking the newspaper and notice an arbitrage opportunity. The current stock price of Intrawest is \$20 per share and the one-year risk-free interest rate is 8%. A one-year put on Intrawest with a strike price of \$18 sells for \$3.33, while the identical call sells for \$7. Explain what you must do to exploit this arbitrage opportunity.
19. Consider the September 2012 IBM call and put options in Problem 3. Ignoring the negligible interest you might earn on T-bills over the remaining few days' life of the options, show that there is no arbitrage opportunity using put-call parity for the options with a \$205 strike price. Specifically:
 - a. What is your profit/loss if you buy a call and T-bills, and sell IBM stock and a put option?
 - b. What is your profit/loss if you buy IBM stock and a put option, and sell a call and T-bills?
 - c. Explain why your answers to (a) and (b) are not both zero.

Factors Affecting Option Prices

20. Suppose Amazon stock is trading for \$70 per share, and Amazon pays no dividends.
 - a. What is the maximum possible price of a call option on Amazon?
 - b. What is the maximum possible price of a put option on Amazon with a strike price of \$100?
 - c. What is the minimum possible value of a call option on Amazon stock with a strike price of \$50?
 - d. What is the minimum possible value of an American put option on Amazon stock with a strike price of \$100?
21. Consider the data for IBM options in Problem 3. Suppose a new American-style put option on IBM is issued with a strike price of \$215 and an expiration date of October 1st.
 - a. What is the maximum possible price for this option?
 - b. What is the minimum possible price for this option?
22. You are watching the option quotes for your favorite stock, when suddenly there is a news announcement. Explain what type of news would lead to the following effects:
 - a. Call prices increase, and put prices fall.
 - b. Call prices fall, and put prices increase.
 - c. Both call and put prices increase.

Exercising Options Early

- *23. Explain why an American call option on a non-dividend-paying stock always has the same price as its European counterpart.

24. Consider an American put option on XAL stock with a strike price of \$55 and one year to expiration. Assume XAL pays no dividends, XAL is currently trading for \$10 per share, and the one-year interest rate is 10%. If it is optimal to exercise this option early:
- What is the price of a one-year American put option on XAL stock with a strike price of \$60 per share?
 - What is the maximum price of a one-year American call option on XAL stock with a strike price of \$55 per share?
25. The stock of Harford Inc. is about to pay a \$0.30 dividend. It will pay no more dividends for the next month. Consider call options that expire in one month. If the interest rate is 6% APR (monthly compounding), what is the maximum strike price where it could be possible that early exercise of the call option is optimal? (Round to the nearest dollar.)
26. Suppose the S&P 500 is at 900, and a one-year European call option with a strike price of \$400 has a negative time value. If the interest rate is 5%, what can you conclude about the dividend yield of the S&P 500? (Assume all dividends are paid at the end of the year.)
27. Suppose the S&P 500 is at 900, and it will pay a dividend of \$30 at the end of the year. Suppose also that the interest rate is 2%. If a one-year European put option has a negative time value, what is the lowest possible strike price it could have?

Options and Corporate Finance

28. Wesley Corp. stock is trading for \$25/share. Wesley has 20 million shares outstanding and a market debt-equity ratio of 0.5. Wesley's debt is zero-coupon debt with a 5-year maturity and a yield to maturity of 10%.
- Describe Wesley's equity as a call option. What is the maturity of the call option? What is the market value of the asset underlying this call option? What is the strike price of this call option?
 - Describe Wesley's debt using a call option.
 - Describe Wesley's debt using a put option.
- *29. Express the position of an equity holder in terms of put options.
30. Use the option data from July 13, 2009 in the following table to determine the rate Google would have paid if it had issued \$128 billion in zero-coupon debt due in January 2011. Suppose Google currently had 320 million shares outstanding, implying a market value of \$135.1 billion. (Assume perfect capital markets.)

GOOG

Jul 13 2009 @ 13:10 ET

422.27 +7.87

Vol 2177516

Calls	Bid	Ask	Open Int
11 Jan 150.0 (OZF AJ)	273.60	276.90	100
11 Jan 160.0 (OZF AL)	264.50	267.20	82
11 Jan 200.0 (OZF AA)	228.90	231.20	172
11 Jan 250.0 (OZF AU)	186.50	188.80	103
11 Jan 280.0 (OZF AX)	162.80	165.00	98
11 Jan 300.0 (OZF AT)	148.20	150.10	408
11 Jan 320.0 (OZF AD)	133.90	135.90	63
11 Jan 340.0 (OZF AI)	120.50	122.60	99
11 Jan 350.0 (OZF AK)	114.10	116.10	269
11 Jan 360.0 (OZF AM)	107.90	110.00	66
11 Jan 380.0 (OZF AZ)	95.80	98.00	88
11 Jan 400.0 (OZF AU)	85.10	87.00	2577
11 Jan 420.0 (OUP AG)	74.60	76.90	66
11 Jan 450.0 (OUP AV)	61.80	63.30	379

- *31. Suppose that in July 2009, Google were to issue \$96 billion in zero-coupon senior debt, and another \$32 billion in zero-coupon junior debt, both due in January 2011. Use the option data in the preceding table to determine the rate Google would pay on the junior debt issue. (Assume perfect capital markets.)

Data Case

Your uncle owns 10,000 shares of Wal-Mart stock. He is concerned about the short-term outlook for Wal-Mart's stock due to an impending "major announcement." This announcement has received much attention in the press so he expects the stock price will change significantly in the next month, but is unsure whether it will be a profit or a loss. He hopes the price will increase, but he also doesn't want to suffer if the price were to fall in the short term.

His broker recommended he buy a "protective put" on the stock, but your uncle has never traded options before and is not much of a risk taker. He wants you to devise a plan for him to capitalize if the announcement is positive but to still be protected if the news causes the price to drop. You realize that a protective put will protect him from the downside risk, but you think a straddle may offer similar downside protection, while increasing the upside potential. You decide to show him both strategies and the resulting profits and returns he could face from each.

1. Download option quotes on options that expire in approximately one month on Wal-Mart from the Chicago Board Options Exchange (www.cboe.com) into an Excel spreadsheet (click the Quotes & Data tab at the top left portion of the screen and then select "Delayed Quotes"). If you choose to download "near term at-the-money" options you will get a range of options expiring in about a month. *Note:* You can only get active quotes while the exchange is open; bid or ask prices are not available when it is closed.
2. Determine your uncle's profit and return using the protective put.
 - a. Identify the expiring put with an exercise price closest to, but not below, the current stock price. Determine the investment required to protect all 10,000 shares.
 - b. Determine the put price at expiration for each stock price at \$5 increments within a range of \$40 of Wal-Mart's current price using Eq. 20.2.
 - c. Compute the profit (or loss) on the put for each stock price used in part (b).
 - d. Compute the profit on the stock from the current price for each stock price used in part (b).
 - e. Compute his overall profit (or loss) of the protective put, that is, combining the put and his stock for each price used in parts (c) and (d).
 - f. Compute the overall return of the protective put.
3. Determine your uncle's profit and return using the straddle.
 - a. Compute the investment your uncle would have to make to purchase the call and put with the same exercise price and expiration as the put option in Question 2, to cover all 10,000 of his shares.
 - b. Determine the value at expiration of the call and the put options at each \$5 increment of stock prices within a range of \$40 of Wal-Mart's current price using Eqs. 20.1 and 20.2.
 - c. Determine the profit (or loss) on the options at each stock price used in part (b).
 - d. Determine the profit (or loss) on the stock from the current price for each stock price used in part (b).
 - e. Compute his overall profit (or loss) of the stock plus straddle, that is, combining the position in both options and his stock for each price used in parts (c) and (d).
 - f. Compute the overall return of this position.
4. Was the broker correct that the protective put would prevent your uncle from losing if the announcement caused a large decrease in the stock value? What is your uncle's maximum possible loss using the protective put?
5. What is the maximum possible loss your uncle could experience using the straddle?
6. Which strategy, the protective put or the straddle, provides the maximum upside potential for your uncle? Why does this occur?