Solutions for Options Futures and Other Derivatives 11th Edition by Hull

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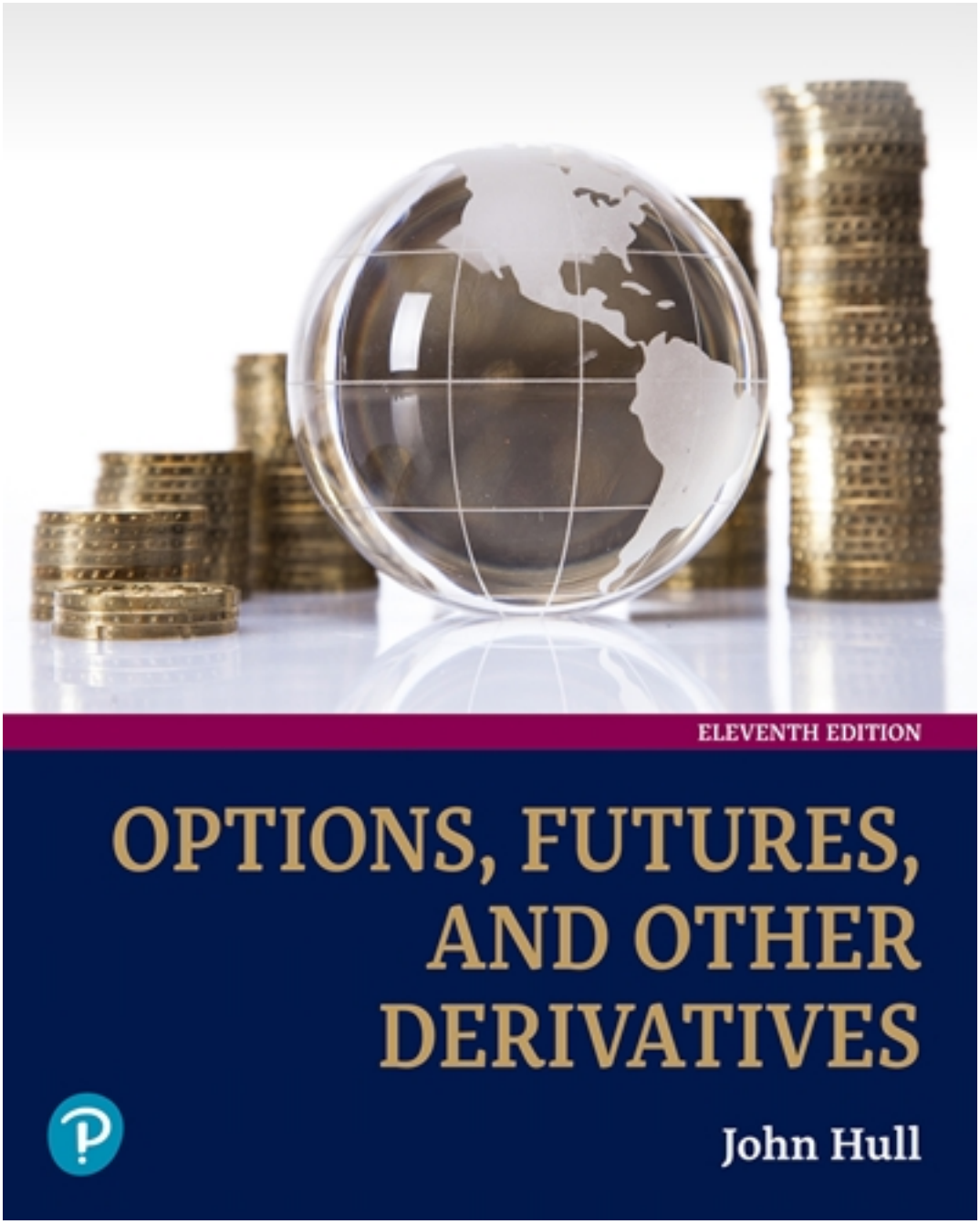

Solutions

ANSWERS TO ASSIGNMENT QUESTIONS

Chapter 1

1A

An investment in call options entails higher risks but can lead to higher returns. If the stock price stays at $94, an investor who buys call options loses $9,400 whereas an investor who buys shares neither gains nor loses anything. If the stock price rises to $120, the investor who buys call options gains

$$2000\times(120-95)-9400=\$40,600$$

An investor who buys shares gains

$$100\times(120-94)=\$2,600$$

The strategies are equally profitable if the stock price rises to a level, *S*, where

$$100\times(S-94)=2000(S-95)-9400$$

or,

$$S=100$$

The option strategy is therefore more profitable if the stock price rises above $100.

1B

ImportCo should buy three-month call options on $10 million with a strike price of 1.2400. ExportCo should buy three-month put options on $30 million with a strike price of 1.2000. In this case, the spot foreign exchange rate is 1.22185 (the average of the bid and offer quotes in Table 1.1.), the (domestic) risk-free rate is 2%, the foreign risk-free rate is 1%, the volatility is 12%, and the time to exercise is 0.25 years. Using the **Equity_FX_Index_Futures_Options** worksheet in the DerivaGem Options Calculator select Currency as the underlying and Black–Scholes–European as the option type. The software shows that a call with a strike price of 1.24 is worth 0.02245 and a put with a strike of 1.20 is worth 0.01816. This means that the hedging would cost 0.022245 × 10,000,000 or about $222,450 for ImportCo and 0.01816 × 30,000,000 or about $544,800 for ExportCo.

1C

The trader has a long European call option with strike price K and a short European put option with strike price K. Suppose the price of the underlying asset at the maturity of the option is S_T. If $S_T > K$, the call option is exercised by the investor and the put option expires worthless. The payoff from the portfolio is then $S_T - K$. If $S_T < K$, the call option expires worthless and the put option is exercised against the investor. The cost to the investor is $K - S_T$. Alternatively, we can say that the payoff to the investor in this case is $S_T - K$ (a negative amount). In all cases, the payoff is $S_T - K$, the same as the payoff from the forward contract. The trader's position is equivalent to a forward contract with delivery price K.

Suppose that F is the forward price. If $K = F$, the forward contract that is created has zero value. Because the forward contract is equivalent to a long call and a short put, this shows that the price of a call equals the price of a put when the strike price is F.

Chapter 2

2A

The price goes up during the time the company holds the contract from 120 to 125 cents per pound. Overall the company therefore takes a loss of 15,000 × 0.05 = $750. If the company is classified as a hedger, this loss is realized in 2023, If it is classified as a speculator, it realizes a loss of 15,000 × 0.20 = $3000 in 2021, a gain of 15,000 × 0.30 = $4,500 in 2022, and a loss of 15,000 × 0.15 = $2,250 in 2023.

2B

If the transactions are cleared bilaterally, the company has to provide collateral to Banks A, B, and C of (in millions of dollars) 0, 15, and 25, respectively. The total collateral required is $40 million. If the transactions are cleared centrally, they are netted against each other and the company's total variation margin (in millions of dollars) is –20 + 15 + 25 or $20 million in total. The total margin required (including the initial margin) is therefore $30 million.

2C Excel file

(a) For crude oil, the standard deviation of daily changes is $1.5777 per barrel or $1577.7 per contract. The standard deviation of two-day price changes is $1577.7 × $\sqrt{2}$ = $2,231.2 per contract.
(b) Margin for member = $2,231.2 × 2.326 = $5,190.6
(c) Worksheet shows that the margin would be wiped out 24 times or on 2.31% of the days. This suggests that price changes have heavier tails than the normal distribution.
(d) Worksheet shows that there would be 157 margin calls and the client has an incentive to default 9 times.

Chapter 3

3A (Excel file)

Denote x_i and y_i by the i-th observation on the change in the futures price and the change in the spot price, respectively.

$$\sum x_i = 0.96 \quad \sum y_i = 1.30$$

$$\sum x_i^2 = 2.4474 \quad \sum y_i^2 = 2.3594$$

$$\sum x_i y_i = 2.352$$

An estimate of σ_F is

$$\sqrt{\frac{2.4474}{9}-\frac{0.96^2}{10\times 9}}=0.5116$$

An estimate of σ_S is

$$\sqrt{\frac{2.3594}{9}-\frac{1.30^2}{10\times 9}}=0.4933$$

An estimate of ρ is

$$\frac{10\times 2.352-0.96\times 1.30}{\sqrt{(10\times 2.4474-0.96^2)(10\times 2.3594-1.30^2)}}=0.981$$

The minimum variance hedge ratio is

$$\rho\frac{\sigma_S}{\sigma_F}=0.981\times\frac{0.4933}{0.5116}=0.946$$

3B (Excel file)

a) The number of contracts the fund manager should short is

$$0.87\times\frac{50,000,000}{1259\times 250}=138.20$$

Rounding to the nearest whole number, 138 contracts should be shorted.

b) The following table shows the impact of the strategy. To illustrate the calculations in the table, consider the first column. If the index in two months is 1,000, the futures price is 1000 × 1.0025. The gain on the short futures position is therefore

$$(1259-1002.50)\times 250\times 138=\$8,849,250$$

The return on the index is $3\times 2/12=0.5\%$ in the form of dividend and $-250/1250=-20\%$ in the form of capital gains. The total return on the index is therefore -19.5%. The risk-free rate is 1% per two months. The return is therefore -20.5% in excess of the risk-free rate. From the capital asset pricing model, we expect the return on the portfolio to be $0.87\times -20.5\%=-17.835\%$ in excess of the risk-free rate. The portfolio return is therefore -16.835%. The loss on the portfolio is $0.16835\times 50,000,000$ or $8,417,500. When this is combined with the gain on the futures, the total gain is $431,750.

Index now	1250	1250	1250	1250	1250
Index Level in Two Months	1000	1100	1200	1300	1400
Return on Index in Two Months	-0.20	-0.12	-0.04	0.04	0.12
Return on Index incl divs	-0.195	-0.115	-0.035	0.045	0.125
Excess Return on Index	-0.205	-0.125	-0.045	0.035	0.115
Excess Return on Portfolio	-0.178	-0.109	-0.039	0.030	0.100
Return on Portfolio	-0.168	-0.099	-0.029	0.040	0.110
Portfolio Gain	-8,417,500	-4,937,500	-1,457,500	2,022,500	5,502,500
Futures Now	1259	1259	1259	1259	1259
Futures in Two Months	1002.50	1102.75	1203.00	1303.25	1403.50
Gain on Futures	8,849,250	5,390,625	1,932,000	-1,526,625	-4,985,250
Net Gain on Portfolio	431,750	453,125	474,500	495,875	517,250

3C

To hedge the February 2022 purchase, the company should take a long position in March 2022 contracts for the delivery of 800,000 pounds of copper. The total number of contracts required is $800,000/25,000=32$. Similarly, a long position in 32 September 2022 contracts is required to hedge the August 2022 purchase. For the February 2023 purchase, the company could take a long position in 32 September 2022 contracts and roll them into March 2023 contracts during August 2022. (As an alternative, the company could hedge the February 2023 purchase by taking a long position in 32 March 2022 contracts and rolling them into March 2023 contracts.) For the August 2023 purchase, the company could take a long position in 32 September 2022 and roll them into September 2023 contracts during August 2022.

The strategy is therefore as follows:

Oct. 2021: Enter into long position in 96 Sept. 2022 contracts

Enter into a long position in 32 Mar. 2022 contracts

Feb 2022: Close out 32 Mar. 2022 contracts

Aug 2022: Close out 96 Sept. 2022 contracts

Enter into long position in 32 Mar. 2023 contracts

Enter into long position in 32 Sept. 2023 contracts

Feb 2023: Close out 32 Mar. 2023 contracts

Aug 2023: Close out 32 Sept. 2023 contracts

With the market prices shown the company pays

$$369.00+0.8\times(372.30-369.10)=371.56$$

for copper in February 2022. It pays

$$365.00+0.8\times(372.80-364.80)=371.40$$

for copper in August 2022. As far as the February 2023 purchase is concerned, it loses $372.80-364.80=8.00$ on the September 2022 futures and gains $376.70-364.30=12.40$ on the February 2023 futures. The net price paid is therefore,

$$377.00+0.8\times8.00-0.8\times12.40=373.48$$

As far as the August 2023 purchase is concerned, it loses $372.80-364.80=8.00$ on the September 2022 futures and gains $388.20-364.20=24.00$ on the September 2023 futures. The net price paid is therefore,

$$388.00+0.8\times8.00-0.8\times24.00=375.20$$

The hedging strategy succeeds in keeping the price paid in the range 371.40 to 375.20.

In October 2021, the initial margin requirement on the 128 contracts is $128\times\$2{,}000$ or $256,000. There is a margin call when the futures price drops by more than 2 cents. This happens to the March 2022 contract between October 2021 and February 2022, to the September 2022 contract between October 2021 and February 2022, and to the September 2022 contract between February 2022 and August 2022. (Under the plan, above the March 2023 contract is not held between February 2022 and August 2022, but if it were there would be a margin call during this period.)

Chapter 4

4A

(a) With continuous compounding the 6-month rate is $2\ln1.02=0.039605$ or 3.961%. The 12-month rate is $2\ln1.0225=0.044501$ or 4.4501%. The 18-month rate is $2\ln1.02375=0.046945$ or 4.6945%. The 24-month rate is $2\ln1.025=0.049385$ or 4.9385%.

(b) The forward rate (expressed with continuous compounding) is from equation (4.5)

$$\frac{4.9385\times2-4.6945\times1.5}{0.5}$$

or 5.6707%. When expressed with semiannual compounding, this is $2(e^{0.056707\times0.5}-1)=0.057518$ or 5.7518%.

(c) The formula for the par yield is

$$c=\frac{(100-100d)m}{A}$$

In this case $d = (1/1.025)^4 = 0.90595$, $m = 2$ and

$$A=\frac{1}{1.02}+\frac{1}{1.0225^2}+\frac{1}{1.02375^3}+\frac{1}{1.025^4}=3.7748$$

so that

$$c = \frac{(100 - 90.595) \times 2}{3.7748} = 4.983$$

or 4.983%. By definition, this is also the yield on a two-year bond that pays a coupon equal to the par yield.

4B

The value of the FRA is

$$10{,}000{,}000 \times (0.07 - 0.057518) \times 0.5 \times \frac{1}{1.025^4} = 56{,}540$$

or $56,540.

4C

(a) The zero rate for a maturity of six months, expressed with continuous compounding is $2\ln(1+2/98) = 4.0405\%$. The zero rate for a maturity of one year, expressed with continuous compounding is $\ln(1+5/95) = 5.1293$. The 1.5-year rate is R where

$$3.1e^{-0.040405\times 0.5} + 3.1e^{-0.051293\times 1} + 103.1e^{-R\times 1.5} = 101$$

The solution to this equation is $R = 0.054429$. The 2.0-year rate is R where

$$4e^{-0.040405\times 0.5} + 4e^{-0.051293\times 1} + 4e^{-0.054429\times 1.5} + 104e^{-R\times 2} = 104$$

The solution to this equation is $R = 0.058085$. These results are shown in the table below:

Maturity (yrs)	*Zero Rate (%)*	*Forward Rate (%)*	*Par Yield (s.a.%)*	*Par yield (c.c %)*
0.5	4.0405	4.0405	4.0816	4.0405
1.0	5.1293	6.2181	5.1813	5.1154
1.5	5.4429	6.0700	5.4986	5.4244
2.0	5.8085	6.9054	5.8620	5.7778

(b) The continuously compounded forward rates calculated using equation (4.5) are shown in the third column of the table.

(c) The par yield, expressed with semiannual compounding, can be calculated from the formula in Section 4.6. It is shown in the fourth column of the table. In the fifth column of the table, it is converted to continuous compounding.

(d) The price of the bond is

$$3.5e^{-0.040405\times 0.5} + 3.5e^{-0.051293\times 1} + 3.5e^{-0.054429\times 1.5} + 103.5e^{-0.058085\times 2} = 102.13$$

The yield on the bond, y satisfies

ASSIGNMENT QUESTIONS

Chapter 1

1A
The current price of a stock is $94, and three-month call options with a strike price of $95 currently sell for $4.70. An investor who feels that the price of the stock will increase is trying to decide between buying 100 shares and buying 2,000 call options (20 contracts). Both strategies involve an investment of $9,400. What advice would you give? How high does the stock price have to rise for the option strategy to be more profitable?

1B
Describe how foreign currency options can be used for hedging in the situation considered in Section 1.7 so that (a) ImportCo is guaranteed that its exchange rate will be less than 1.2400, and (b) ExportCo is guaranteed that its exchange rate will be at least 1.2000. Use DerivaGem to calculate the cost of setting up the hedge in each case assuming that the exchange rate volatility is 12%, interest rates in the United States are 2% and interest rates in Britain are 1%. Assume that the current exchange rate is the average of the bid and offer in Table 1.1.

1C
A trader buys a European call option and sells a European put option. The options have the same underlying asset, strike price, and maturity. Describe the trader's position. Under what circumstances does the price of the call equal the price of the put?

Chapter 2

2A
One orange juice future contract is on 15,000 pounds of frozen concentrate. Suppose that in September 2021 a company sells a March 2023 orange juice futures contract for 120 cents per pound. At the end of December 2021 the futures price is 140 cents; at the end of December 2022 the futures price is 110 cents; and in February 2023 it is closed out at 125 cents. The company has a December 31 year end. What is the company's profit or loss on the contract? How is it realized? What is the accounting and tax treatment of the transaction if the company is classified as (a) a hedger, and (b) a speculator?

2B
A company has derivatives transactions with Banks A, B, and C which are worth +$20 million, −$15 million, and −$25 million, respectively, to the company. How much margin or collateral does the company have to provide in each of the following two situations?

(a) The transactions are cleared bilaterally and are subject to one-way collateral agreements where the company posts variation margin, but no initial margin. The banks do not have to post collateral.
(b) The transactions are cleared centrally through the same CCP and the CCP requires a total initial margin of $10 million.

2C
The author's Web page (www-2.rotman.utoronto.ca/~hull/data) contains daily closing prices for crude oil futures contract and gold futures contract. You are required to download the data for crude oil and answer the following:
(a) Assuming that daily price changes are normally distributed with zero mean, estimate the standard deviation of daily price changes. Calculate the standard deviation of two-day changes from the standard deviation of one-day changes assuming that changes are independent.
(b) Suppose that an exchange wants to set the margin requirement for a member with a long position in one contract so that it is 99% certain that the margin will not be wiped out by a two-day price move. (It chooses two days because it considers that it can take two days to close out a defaulting member.) How high does the margin have to be when the normal distribution assumption is made? Each contract is on 1,000 barrels of oil.
(c) Use the data to determine how often the margin of the member would actually be wiped out by a two-day price move. What do your results suggest about the appropriateness of the normal distribution assumption?
(d) Suppose that for retail clients the maintenance margin is equal to the amount calculated in (b) and is 75% of the initial margin. How frequently would the balance in the account of a client with a long position be negative immediately before a margin payment is due (so that the client has an incentive to default)? Assume that balances in excess of the initial margin are withdrawn by the client.

Chapter 3

3A
The following table gives data on monthly changes in the spot price and the futures price for a certain commodity. Use the data to calculate a minimum variance hedge ratio. (Do not make an adjustment for daily settlement.)

Spot Price Change	+0.50	+0.61	−0.22	−0.35	+0.79
Futures Price Change	+0.56	+0.63	−0.12	−0.44	+0.60
Spot Price Change	+0.04	+0.15	+0.70	−0.51	−0.41
Futures Price Change	−0.06	+0.01	+0.80	−0.56	−0.46

3B
A fund manager has a portfolio worth $50 million with a beta of 0.87. The manager is concerned about the performance of the market over the next two months and plans to use three-month

futures contracts on a well-diversified index to hedge its risk. The current level of the index is 1250, one contract is on 250 times the index, the risk-free rate is 6% per annum, and the dividend yield on the index is 3% per annum. The current 3 month futures price is 1259.

(a) What position should the fund manager take to eliminate all exposure to the market over the next two months?

(b) Calculate the effect of your strategy on the fund manager's returns if the level of the market in two months is 1,000, 1,100, 1,200, 1,300, and 1,400. Assume that the one-month futures price is 0.25% higher than the index level at this time.

3C

It is now October 2021. A company anticipates that it will purchase 1 million pounds of copper in each of February 2022, August 2022, February 2023, and August 2023. The company has decided to use the futures contracts traded by the CME Group to hedge its risk. One contract is for the delivery of 25,000 pounds of copper. The initial margin is $2,000 per contract and the maintenance margin is $1,500 per contract. The company's policy is to hedge 80% of its exposure. Contracts with maturities up to 13 months into the future are considered to have sufficient liquidity to meet the company's needs. Devise a hedging strategy for the company. (Do not make the adjustment for daily settlement described in Section 3.4.)

Assume the market prices (in cents per pound) today and at future dates are as follows. What is the impact of the strategy you propose on the price the company pays for copper? What is the initial margin requirement in October 2021? Is the company subject to any margin calls?

Date	Oct 2021	Feb 2022	Aug 2022	Feb 2023	Aug 2023
Spot Price	372.00	369.00	365.00	377.00	388.00
Mar 2022 Futures Price	372.30	369.10			
Sep 2022 Futures Price	372.80	370.20	364.80		
Mar 2023 Futures Price		370.70	364.30	376.70	
Sep 2023 Futures Price			364.20	376.50	388.20

Chapter 4

4A

The 6-month, 12-month, 18-month, and 24-month zero rates are 4%, 4.5%, 4.75%, and 5%, respectively, with semiannual compounding.

(a) What are the rates with continuous compounding?

(b) What is the forward rate for the six-month period beginning in 18 months?

EXTRA PROBLEMS 1 (Answers at end)

1. A box spread is a combination of a bull spread composed of two call options with strike prices X_1 and X_2 and a bear spread composed of two put options with the same two strike prices.
   a) Describe the payoff from a box spread on the expiration date of the options.
   b) What would be a fair price for the box spread today? Define variables as necessary.
   c) Under what circumstances might an investor choose to construct a box spread?
   d) What sort of investor do you think is most likely to invest in such an option combination, that is, a hedger, speculator, or arbitrageur? Explain your answer.

2. Form a long butterfly spread using the three call options in the table below.

	C1 **X = $90** **T = 180 days**	**C2** **X = $100** **T = 180 days**	**C3** **X = $110** **T = 180 days**
Price	16.3300	10.3000	6.0600
DELTA	0.7860	0.6151	0.4365
GAMMA	0.0138	0.0181	0.0187
THETA	–11.2054	–12.2607	–11.4208
VEGA	20.4619	26.8416	27.6602
RHO	30.7085	25.2515	18.5394

   a) What does it cost to establish the butterfly spread?
   b) Calculate each of the Greek measures for this butterfly spread position and explain how each can be interpreted.
   c) How would you make this option portfolio delta neutral? What would be achieved by doing so?
   d) Suppose that tomorrow the price of C1 falls to $12.18 while the prices of C2 and C3 remain the same. Does this create an arbitrage opportunity? Explain.

3. Consider a six month American put option on index futures where the current futures price is 450, the exercise price is 450, the risk-free rate of interest is 7% per annum, the continuous dividend yield of the index is 3%, and the volatility of the index is 30% per annum. The futures contract underlying the option matures in seven months. Using a three-step binomial tree, calculate:
   a) The price of the American put option now.
   b) The delta of the option with respect to the futures price.
   c) The delta of the option with respect to the index level.
   d) The price of the corresponding European put option on index futures.
   e) Apply the control variate technique to improve your estimate of the American option price **and** of the delta of the option with respect to the futures price.

   Note that the Black−Scholes price of the European put option is $36.704 and the delta with respect to the futures price given by Black−Scholes is –0.442.

4. A financial institution trades swaps where 12 month LIBOR is exchanged for a fixed rate of interest. Payments are made once a year. The one-year swap rate (i.e., the rate that

EXTRA PROBLEMS 2 (Answers in red)

1. In July 2012, a small chocolate factory receives a large order for chocolate bars to be delivered in November. The spot price for cocoa is $2,400 per metric ton. It will need 10 metric tons of cocoa in September to fill this order. Because of limited storage capacity and volatility in the world cocoa prices, the company decides the best strategy is to buy 10 call options for $53 each with strike price of $2,400 (equal to the current price) with a maturity date of September 2012. When the options expire in September, how much will the company pay (including the cost of the options) for cocoa if the spot price in September proves to be: a) $2,300, and b) $2,600? ($23,530, $24,530)

2. A trader invests in Facebook by buying 1,000 shares in June for $27 per share. She also buys 1,000 put options for $5 each as insurance in case the stock drops sharply. The put options have a strike price of $27 and a maturity date of December. What is the gain or loss if the spot price on December is: (a) $20, (b) $27, (c) $32, and (d) $37? ($5,000 loss, $5,000 loss, $0, $5,000 gain)

3. The spot price for Google stock is $578 on June 6. A trader considers two alternatives: buy 100 shares of the stock, or buy 100 European call options on Google for $38 each with a strike price of $575 and maturity date of September 2012. For each alternative, what is: (a) the upfront cost? (b) The total gain if the stock price at maturity is $650? (c) The total loss if the stock price is $500 at maturity? ($57,800 and $3,800; $7,200 and $3,700; –$7,800 and –$3,800)

4. A trader takes the long position and a hedge fund takes a short position on ten 1-month S&P 500 futures contracts at 1,300. A single S&P 500 futures contract equals ($250) × (index value). The initial margin is $325,000 and the maintenance margin is $245,000 for both accounts. Ten trading days later, the futures price of the index drops to 1,260 triggering a margin call for the trader. What is the change margin account balance (indicate gain or loss) for: (a) the trader, and (b) the hedge fund? What is the margin call for the trader? (trader: $100,000 loss, hedge fund: $100,000 gain, margin call: $100,000)

5. A speculator sells a July 2013 wheat futures contract at 721 cents per bushel. Each futures contract is for 5,000 bushels. The futures price drops to 676 on December 31, 2012 and rises to 712 in May 2013 when she closes the contract. What is the gain or loss for accounting purposes in 2013? ($180,000 loss)

6. In December 2011, a company expects to buy 100,000 MMBtu of natural gas before the end of March 2012, but does not know exactly when. To hedge against volatile gas prices, it implements a rolling forward hedge by taking a long position on 10 two-month natural gas futures (only held for 1 month). One futures contract is for 10,000 MMBtu and is quoted in $ per MMBtu. The commodity is purchased in March 2012. What is total dollar gain/loss from the rolling hedge? Assume a hedge ratio of 0.8.

John Hull
Options, Futures, and Other Derivatives, 11th Edition
Notes for Instructors

This document contains notes on each chapter of Options, Futures, and Other Derivatives, eleventh edition. These notes make some suggestions on the teaching of the chapters and mention some of the differences between the 10th and 11th editions.

CHAPTER 1
Introduction

This chapter introduces the markets for futures, forward, and option contracts and explains the activities of hedgers, speculators, and arbitrageurs. It explains the new regulations for OTC markets introduced since the crisis and the role of CCPs. Issues concerning futures contracts such as margin requirements, settlement procedures, the role of the clearinghouse, etc. are covered in Chapter 2. The tables and examples have been updated in this chapter and later chapters for the 11th edition.

Some instructors prefer to avoid any mention of options until the material on linear products in Chapters 1 to 7 has been covered. The book introduces students to options in the first chapter, even though they are not mentioned again for several more chapters. This is because most students find options to be the most interesting of the derivatives covered and it helps maintain their enthusiasm for the material.

The way in which the material in Chapter 1 is covered is likely to depend on the backgrounds of the students. If a course in investments is a prerequisite, Chapter 1 can be regarded as a review of material already familiar to the students and can be covered fairly quickly. If an investments course is not a prerequisite, more time may be required. Increasingly, some aspects of derivatives markets are being covered in introductory corporate finance courses, accounting courses, strategy courses, etc. In many instances, students are, therefore, likely to have had some exposure to the material in Chapter 1.

To motivate students at the outset of the course, the instructor can discuss the growing importance of derivatives, how much experts in the field are paid, etc. It is not uncommon for students who join derivatives groups, and are successful, to earn (including bonus) several hundred thousand dollars a year—or even $1 million per year—three or four years after graduating. The role of derivatives in the crisis and the Lehman's bankruptcy is likely to come up. A discussion of the crisis can be deferred until the Chapter 8 material is covered.

Toward the end of the first class, the instructor can produce a current newspaper and describe several traded futures and options. Students can then guess the quoted prices. Votes can be taken. This is an enjoyable exercise and forces students to think actively about the nature of the contracts and the determinants of price. It usually leads to a preliminary discussion of such issues as the relationship between a futures price and the corresponding spot price, the desirability of options being exercised early, why most options sell for more than their intrinsic value, etc.

In Chapter 1, futures are treated as the same as forwards. The instructor can avoid being drawn into a discussion of such issues as the mechanics of futures, margin require-

ments, daily settlement procedures, and so on until ready. These topics are covered in Chapter 2.

A little of the Chapter 5 material can be introduced during the first class if desired. This is done at the end of Section 1.4.

CHAPTER 2
Futures Markets and Central Counterparties

This chapter explains the functioning of futures markets. Some instructors will not want to use classroom time to explain in great detail how futures markets work. (Students can read this for themselves.) However, it is worth spending some time going through Table 2.1 to explain the way in which margin accounts work. After the essentials of the operations of futures markets have been explained, students can be asked to consider Problem 2.27 in class because this often reveals gaps in their understanding. About $1\frac{1}{2}$ hours is necessary to cover the material in the chapter.

In many ways, OTC markets are becoming more like exchange-traded markets as a result of post-crisis regulation. Once the way margin accounts are used for futures has been explained, it is natural to talk about how collateralization works in the OTC market (see Section 2.5).

There are many ways of making a discussion of futures markets fun. An easy-to-organize trading game that was explained to me by a Wall Street training manager works as follows. The instructor chooses two students to keep trading records on the front board and divides the rest of the students into about ten groups. Each group is given an identifier (e.g., A, B, C, etc) and a card with the identifier shown in big letters. They display the card when they want to make trades. The instructor chooses a seven-digit telephone number, but does not reveal this to students. The groups trade the sum of digits of the telephone number by entering long or short positions. For example, group B might bid (i.e., offer to buy) at 35. If this is accepted by another group (say group D), the record keepers show that B is long one contract at 35 and D is short one contract at 35. (If the actual sum of digits is 32, B is -3 on the trade and D is $+3$.) The instructor controls the trading, asks for bids or offers as appropriate, and shouts trades to the record keepers. Every two minutes the instructor reveals one of the digits of the number. This game nearly always works very well for me. Trading typically starts slowly and then becomes very intense. The game gives students a sense of what futures trading is like. (They should use the words "bid" and "offer" rather than "buy" and "sell.") It shows how prices are formed in markets. After the game is over, we discuss how the market price moved during the game. The records also usually show different trading strategies. Some groups are usually speculators (all trades are long or all are short) and others are like day traders (e.g., buy at 35, sell at 36, buy at 38, sell at 39, etc). It can be pointed out to students that we need both types of traders to make the market work.

There are many stories that can be told about futures markets. Students are often interested in attempts to corner markets. The Hunt brothers' exploits in the silver market (mentioned in footnote 7 of Section 2.9) bankrupted them because the exchange forced them to close out their positions prior to the delivery month and as a result the price dropped. The brothers tried unsuccessfully to sue the exchange.

Business Snapshot 2.1 is an amusing story that can be told in class. Business Snapshot 2.2 (on Long Term Capital Management) fits in well when the operation of margin accounts is being explained.

CHAPTER 3
Hedging Strategies Using Futures

This chapter discusses how long and short futures positions are used for hedging. It covers basis risk, hedge ratios, the use of stock index futures, and stack and roll strategies. The discussion in Section 3.4 has been improved for this edition.

The section on arguments for and against hedging often generates a lively discussion. It is important to emphasize that the purpose of hedging is to reduce the standard deviation of the outcome, not to increase its expected value. Problem 3.24 can be discussed at some stage to emphasize the point that, even in relatively simple situations, it is easy to make incorrect hedging decisions when you do not look at the big picture.

Business Snapshot 3.1 discusses hedging by gold mining companies. This can be used to emphasize the importance of communicating with shareholders. It can lead to a discussion of how investment banks hedge their risks when they enter into forward contracts with gold producers. (This is the second part of Business Snapshot 3.1.) Lease rates and their determination can be covered. If more gold producers choose to hedge, the gold lease rate goes up because there is a greater demand on the part of investment banks for gold borrowing.

CHAPTER 4
Interest Rates

This chapter now recognizes that LIBOR will be phased out at the end of 2021. It covers the overnight reference rates that will replace LIBOR and the way they will be used. The determination of OIS zero curves has been moved to Chapter 7. The discussion of FRAs has been simplified.

The chapter covers interest rate compounding issues. When students are introduced to continuous compounding early in a course, they typically have little difficulty with it. They should understand that we are talking about nothing more than a unit of measurement. Moving from quarterly compounding to continuous compounding is like changing the unit of measurement of distance from miles to kilometers.

The first part of the chapter discusses zero rates, bond valuation, bond yields, par yields, and the calculation of Treasury zero curves. The slides mirror the examples in the text. When covering the bootstrap method to calculate a zero curve, it can be pointed out that the bootstrap method is a very popular approach, but it is not the only one that is used in practice. For example, some analysts use cubic or exponential splines.

The chapter covers the relationship between spot and forward interest rates, FRAs, and theories of the term structure. Instructors can explain that it is possible to enter into transactions that lock in the forward rate for a future time period and then discuss the Orange County story (Business Snapshot 4.1). Orange County entered into contracts (often highly levered) that paid off if the forward rate was higher than the realized future