E-Investments

Real and Nominal Yield Curves

The U.S. Treasury releases yields for several points along the yield curve on its Web site. You can check it out at **www.treas.gov/offices/domestic-finance/debt-management/interest-rate/yield.shtml.** Look for links to both the nominal yield curve (the yield curve on "regular" bonds for which the dollar payments are fixed in advance), as well as the yield curve derived from inflation-indexed Treasury bonds, or TIPS. What inflation forecast seems to be consistent with the 5-year bonds? What about the 20-year bonds? Are there reasons besides expectations that yields on indexed and nominal bonds might differ? Compare the slopes of the real and the nominal yield curves. Why might they differ?

PROBLEMS

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1. Briefly explain why bonds of different maturities have different yields in terms of the expectations and liquidity preference hypotheses. Briefly describe the implications of each hypothesis when the yield curve is (1) upward sloping and (2) downward sloping.
2. Which one of the following statements about the term structure of interest rates is true?
   a. The expectations hypothesis indicates a flat yield curve if anticipated future short-term rates exceed current short-term rates.
   b. The expectations hypothesis contends that the long-term rate is equal to the anticipated short-term rate.
   c. The liquidity premium theory indicates that, all else being equal, longer maturities will have lower yields.
   d. The liquidity preference theory contends that lenders prefer to buy securities at the short end of the yield curve.
3. What is the relationship between forward rates and the market's expectation of future short rates? Explain in the context of both the expectations and liquidity preference theories of the term structure of interest rates.
4. Under the expectations hypothesis, if the yield curve is upward sloping, the market must expect an increase in short-term interest rates. True/false/uncertain? Why?
5. Under the liquidity preference theory, if inflation is expected to be falling over the next few years, long-term interest rates will be higher than short-term rates. True/false/uncertain? Why?
6. The following is a list of prices for zero-coupon bonds of various maturities. Calculate the yields to maturity of each bond and the implied sequence of forward rates.

Maturity (Years)	Price of Bond, $
1	$943.40
2	898.47
3	847.62
4	792.16

7. Assuming that the expectations hypothesis is valid, compute the expected price path of the 4-year bond in Problem 6 as time passes. What is the rate of return of the bond in each year? Show that the expected return equals the forward rate for each year.

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8. The following table shows yields to maturity of zero-coupon Treasury securities.

Term to Maturity (Years)	Yield to Maturity (%)
1	3.50%
2	4.50
3	5.00
4	5.50
5	6.00
10	6.60

a. Calculate the forward 1-year rate of interest for year 3.
b. Describe the conditions under which the calculated forward rate would be an unbiased estimate of the 1-year spot rate of interest for that year.
c. Assume that a few months earlier, the forward 1-year rate of interest for that year had been significantly higher than it is now. What factors could account for the decline in the forward rate?

9. The 6-month Treasury bill spot rate is 4%, and the 1-year Treasury bill spot rate is 5%. What is the implied 6-month forward rate for 6 months from now?

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10. The tables below show, respectively, the characteristics of two annual-pay bonds from the same issuer with the same priority in the event of default, and spot interest rates. Neither bond's price is consistent with the spot rates. Using the information in these tables, recommend either bond *A* or bond *B* for purchase.

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Bond Characteristics

	Bond *A*	Bond *B*
Coupons	Annual	Annual
Maturity	3 years	3 years
Coupon rate	10%	6%
Yield to maturity	10.65%	10.75%
Price	98.40	88.34

Spot Interest Rates

Term (Years)	Spot Rates (Zero-Coupon)
1	5%
2	8
3	11

11. The current yield curve for default-free zero-coupon bonds is as follows:

Maturity (Years)	YTM (%)
1	10%
2	11
3	12

a. What are the implied 1-year forward rates?
b. Assume that the pure expectations hypothesis of the term structure is correct. If market expectations are accurate, what will the pure yield curve (that is, the yields to maturity on 1- and 2-year zero coupon bonds) be next year?
c. If you purchase a 2-year zero-coupon bond now, what is the expected total rate of return over the next year? What if you purchase a 3-year zero-coupon bond? (Hint: Compute the current and expected future prices.) Ignore taxes.
d. What should be the current price of a 3-year maturity bond with a 12% coupon rate paid annually? If you purchased it at that price, what would your total expected rate of return be over the next year (coupon plus price change)? Ignore taxes.

12. The term structure for zero-coupon bonds is currently:

Maturity (Years)	YTM (%)
1	4%
2	5
3	6

Next year at this time, *you* expect it to be:

Maturity (Years)	YTM (%)
1	5%
2	6
3	7

a. What do *you* expect the rate of return to be over the coming year on a 3-year zero-coupon bond?

b. Under the expectations theory, what yields to maturity does *the market* expect to observe on 1- and 2-year zeros over the coming year? Is the market's expectation of the return on the 3-year bond greater or less than yours?

13. The yield to maturity on 1-year zero-coupon bonds is currently 7%; the YTM on 2-year zeros is 8%. The Treasury plans to issue a 2-year maturity *coupon* bond, paying coupons once per year with a coupon rate of 9%. The face value of the bond is $100.

a. At what price will the bond sell?

b. What will the yield to maturity on the bond be?

c. If the expectations theory of the yield curve is correct, what is the market expectation of the price that the bond will sell for next year?

d. Recalculate your answer to (*c*) if you believe in the liquidity preference theory and you believe that the liquidity premium is 1%.

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14. Sandra Kapple is a fixed-income portfolio manager who works with large institutional clients. Kapple is meeting with Maria VanHusen, consultant to the Star Hospital Pension Plan, to discuss management of the fund's approximately $100 million Treasury bond portfolio. The current U.S. Treasury yield curve is given in the following exhibit. VanHusen states, "Given the large differential between 2-and 10-year yields, the portfolio would be expected to experience a higher return over a 10-year horizon by buying 10-year Treasuries, rather than buying 2-year Treasuries and reinvesting the proceeds into 2-year T-bonds at each maturity date."

Maturity	Yield	Maturity	Yield
1 year	2.00%	6 years	4.15%
2	2.90	7	4.30
3	3.50	8	4.45
4	3.80	9	4.60
5	4.00	10	4.70

a. Indicate whether VanHusen's conclusion is correct, based on the pure expectations hypothesis.

b. VanHusen discusses with Kapple alternative theories of the term structure of interest rates and gives her the following information about the U.S. Treasury market:

Maturity (years)	2	3	4	5	6	7	8	9	10
Liquidity premium (%)	.55	.55	.65	.75	.90	1.10	1.20	1.50	1.60

Use this additional information and the liquidity preference theory to determine what the slope of the yield curve implies about the direction of future expected short-term interest rates.

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15. A portfolio manager at Superior Trust Company is structuring a fixed-income portfolio to meet the objectives of a client. The portfolio manager compares coupon U.S. Treasuries with zero-coupon stripped U.S. Treasuries and observes a significant yield advantage for the stripped bonds:

Term	Coupon U.S. Treasuries	Zero-Coupon Stripped U.S. Treasuries
3 years	5.50%	5.80%
7	6.75	7.25
10	7.25	7.60
30	7.75	8.20

Briefly discuss why zero-coupon stripped U.S. Treasuries could yield more than coupon U.S. Treasuries with the same final maturity.

16. Below is a list of prices for zero-coupon bonds of various maturities.

Maturity	Price of $1,000 Par Bond (Zero-Coupon)
1 year	943.40
2	873.52
3	816.37

a. An 8.5% coupon $1,000 par bond pays an annual coupon and will mature in 3 years. What should the yield to maturity on the bond be?

b. If at the end of the first year the yield curve flattens out at 8%, what will be the 1-year holding-period return on the coupon bond?

17. Prices of zero-coupon bonds reveal the following pattern of forward rates:

Year	Forward Rate
1	5%
2	7
3	8

In addition to the zero-coupon bond, investors also may purchase a 3-year bond making annual payments of $60 with par value $1,000.

a. What is the price of the coupon bond?

b. What is the yield to maturity of the coupon bond?

c. Under the expectations hypothesis, what is the expected realized compound yield of the coupon bond?

d. If you forecast that the yield curve in 1 year will be flat at 7%, what is your forecast for the expected rate of return on the coupon bond for the 1-year holding period?

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18. The shape of the U.S. Treasury yield curve appears to reflect two expected Federal Reserve reductions in the Federal Funds rate. The current short-term interest rate is 5%. The first reduction of approximately 50 basis points (bp) is expected 6 months from now and the second reduction of approximately 50 bp is expected 1 year from now. The current U.S. Treasury term premiums are 10 bp per year for each of the next 3 years (out through the 3-year benchmark).

However, the market also believes that the Federal Reserve reductions will be reversed in a single 100 bp increase in the Federal Funds rate 2½ years from now. You expect liquidity premiums to remain 10 bp per year for each of the next 3 years (out through the 3-year benchmark).

Describe or draw the shape of the Treasury yield curve out through the 3-year benchmark. Which term structure theory supports the shape of the U.S. Treasury yield curve you've described?

19. You observe the following term structure:

	Effective Annual YTM
1-year zero-coupon bond	6.1%
2-year zero-coupon bond	6.2
3-year zero-coupon bond	6.3
4-year zero-coupon bond	6.4

a. If you believe that the term structure next year will be the same as today's, will the 1-year or the 4-year zeros provide a greater expected 1-year return?
b. What if you believe in the expectations hypothesis?

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20. U.S. Treasuries represent a significant holding in many pension portfolios. You decide to analyze the yield curve for U.S. Treasury notes.

a. Using the data in the table below, calculate the 5-year spot and forward rates assuming annual compounding. Show your calculations.

U.S. Treasury Note Yield Curve Data

Years to Maturity	Par Coupon Yield to Maturity	Calculated Spot Rates	Calculated Forward Rates
1	5.00	5.00	5.00
2	5.20	5.21	5.42
3	6.00	6.05	7.75
4	7.00	7.16	10.56
5	7.00	?	?

b. Define and describe each of the following three concepts:

i. Short rate.
ii. Spot rate.
iii. Forward rate.

Explain how these concepts are related.

c. You are considering the purchase of a zero-coupon U.S. Treasury note with 4 years to maturity. Based on the above yield-curve analysis, calculate both the expected yield to maturity and the price for the security. Show your calculations.

21. The yield to maturity (YTM) on 1-year zero-coupon bonds is 5% and the YTM on 2-year zeros is 6%. The yield to maturity on 2-year-maturity coupon bonds with coupon rates of 12% (paid annually) is 5.8%. What arbitrage opportunity is available for an investment banking firm? What is the profit on the activity?

22. Suppose that a 1-year zero-coupon bond with face value $100 currently sells at $94.34, while a 2-year zero sells at $84.99. You are considering the purchase of a 2-year-maturity bond making *annual* coupon payments. The face value of the bond is $100, and the coupon rate is 12% per year.

a. What is the yield to maturity of the 2-year zero? The 2-year coupon bond?
b. What is the forward rate for the second year?
c. If the expectations hypothesis is accepted, what are (1) the expected price of the coupon bond at the end of the first year and (2) the expected holding-period return on the coupon bond over the first year?
d. Will the expected rate of return be higher or lower if you accept the liquidity preference hypothesis?

23. Suppose that the prices of zero-coupon bonds with various maturities are given in the following table. The face value of each bond is $1,000.

Maturity	Price
1 year	$925.93
2	853.39
3	782.92
4	715.00
5	650.00

a. Calculate the forward rate of interest for each year.

b. How could you construct a 1-year forward loan beginning in year 3? Confirm that the rate on that loan equals the forward rate.
c. Repeat (*b*) for a 1-year forward loan beginning in year 4.

24. Continue to use the data in the preceding problem. Suppose that you want to construct a *2-year* maturity forward loan commencing in 3 years.
a. Suppose that you buy *today* one 3-year maturity zero-coupon bond. How many 5-year maturity zeros would you have to sell to make your initial cash flow equal to zero?
b. What are the cash flows on this strategy in each year?
c. What is the effective 2-year interest rate on the effective 3-year-ahead forward loan?
d. Confirm that the effective 2-year interest rate equals $(1 + f_4) \times (1 + f_5) - 1$. You therefore can interpret the 2-year loan rate as a 2-year forward rate for the last 2 years. Alternatively, show that the effective 2-year forward rate equals

$$\frac{(1+y_5)^5}{(1+y_3)^3} - 1$$

25. The spot rates of interest for five U.S. Treasury Securities are shown in the following exhibit. Assume all securities pay interest annually.

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Spot Rates of Interest

Term to Maturity	Spot Rate of Interest
1 year	13.00%
2	12.00
3	11.00
4	10.00
5	9.00

a. Compute the 2-year implied forward rate for a deferred loan beginning in 3 years.
b. Compute the price of a 5-year annual-pay Treasury security with a coupon rate of 9% by using the information in the exhibit.

SOLUTIONS TO CONCEPT CHECKS

1. The price of the 3-year bond paying a $40 coupon is

$$\frac{40}{1.05} + \frac{40}{1.06^2} + \frac{1040}{1.07^3} = 38.095 + 35.600 + 848.950 = \$922.65$$

At this price, the yield to maturity is 6.945% [$n = 3$; PV = (−)922.65; FV = 1,000; PMT = 40]. This bond's yield to maturity is closer to that of the 3-year zero-coupon bond than is the yield to maturity of the 10% coupon bond in Example 15.1. This makes sense: this bond's coupon rate is lower than that of the bond in Example 15.1. A greater fraction of its value is tied up in the final payment in the third year, and so it is not surprising that its yield is closer to that of a pure 3-year zero-coupon security.

2. We compare two investment strategies in a manner similar to Example 15.2:

Buy and hold 4-year zero = Buy 3-year zero; roll proceeds into 1-year bond

$$(1+y_4)^4 = (1+y_3)^3 \times (1+r_4)$$
$$1.08^4 = 1.07^3 \times (1+r_4)$$

STANDARD &POOR'S

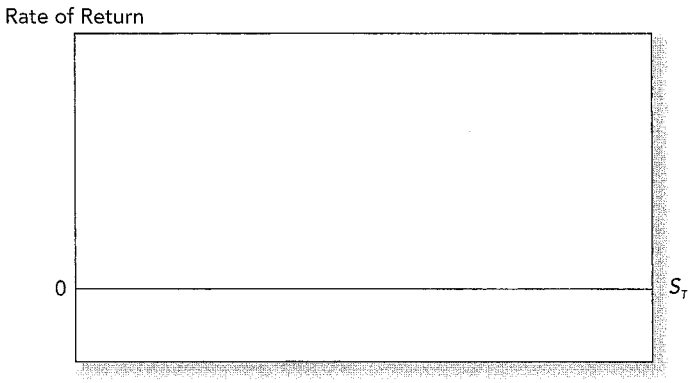
Look back at the April 2006 expiration IBM call and put options, discussed in Examples 20.1 and 20.2 of the chapter. Then go to **www.mhhe.com/edumarketinsight.** Using the *Monthly Adjusted Prices* Excel Analytic report (closing prices), find the payoffs to these options at their expiration.

PROBLEMS

1. Turn back to Figure 20.1, which lists prices of various IBM options. Use the data in the figure to calculate the payoff and the profits for investments in each of the following May maturity options, assuming that the stock price on the maturity date is $85.
   a. Call option, $X = \$80$.
   b. Put option, $X = \$80$.
   c. Call option, $X = \$85$.
   d. Put option, $X = \$85$.
   e. Call option, $X = \$90$.
   f. Put option, $X = \$90$.
2. Suppose you think Wal-Mart stock is going to appreciate substantially in value in the next 6 months. Say the stock's current price, S_0, is $100, and the call option expiring in 6 months has an exercise price, X, of $100 and is selling at a price, C, of $10. With $10,000 to invest, you are considering three alternatives.
   a. Invest all $10,000 in the stock, buying 100 shares.
   b. Invest all $10,000 in 1,000 options (10 contracts).
   c. Buy 100 options (one contract) for $1,000, and invest the remaining $9,000 in a money market fund paying 4% in interest over 6 months (8% per year).

   What is your rate of return for each alternative for the following four stock prices 6 months from now? Summarize your results in the table and diagram below.

	Price of Stock 6 Months from Now			
	$80	$100	$110	$120
a. All stocks (100 shares)				
b. All options (1,000 shares)				
c. Bills + 100 options				



3. The common stock of the P.U.T.T. Corporation has been trading in a narrow price range for the past month, and you are convinced it is going to break far out of that range in the next 3 months. You do not know whether it will go up or down, however. The current price of the stock is \$100 per share, and the price of a 3-month call option at an exercise price of \$100 is \$10.
   a. If the risk-free interest rate is 10% per year, what must be the price of a 3-month put option on P.U.T.T. stock at an exercise price of \$100? (The stock pays no dividends.)
   b. What would be a simple options strategy to exploit your conviction about the stock price's future movements? How far would it have to move in either direction for you to make a profit on your initial investment?
4. The common stock of the C.A.L.L. Corporation has been trading in a narrow range around \$50 per share for months, and you believe it is going to stay in that range for the next 3 months. The price of a 3-month put option with an exercise price of \$50 is \$4.
   a. If the risk-free interest rate is 10% per year, what must be the price of a 3-month call option on C.A.L.L. stock at an exercise price of \$50 if it is at the money? (The stock pays no dividends.)
   b. What would be a simple options strategy using a put and a call to exploit your conviction about the stock price's future movement? What is the most money you can make on this position? How far can the stock price move in either direction before you lose money?
   c. How can you create a position involving a put, a call, and riskless lending that would have the same payoff structure as the stock at expiration? What is the net cost of establishing that position now?
5. In this problem, we derive the put-call parity relationship for European options on stocks that pay dividends before option expiration. For simplicity, assume that the stock makes one dividend payment of \$$D$ per share at the expiration date of the option.
   a. What is the value of a stock-plus-put position on the expiration date of the option?
   b. Now consider a portfolio comprising a call option and a zero-coupon bond with the same maturity date as the option and with face value ($X + D$). What is the value of this portfolio on the option expiration date? You should find that its value equals that of the stock-plus-put portfolio regardless of the stock price.
   c. What is the cost of establishing the two portfolios in parts (*a*) and (*b*)? Equate the costs of these portfolios, and you will derive the put-call parity relationship, Equation 20.2.
6. *a.* A butterfly spread is the purchase of one call at exercise price X_1, the sale of two calls at exercise price X_2, and the purchase of one call at exercise price X_3. X_1 is less than X_2, and X_2 is less than X_3 by equal amounts, and all calls have the same expiration date. Graph the payoff diagram to this strategy.
   b. A vertical combination is the purchase of a call with exercise price X_2 and a put with exercise price X_1, with X_2 greater than X_1. Graph the payoff to this strategy.
7. A bearish spread is the purchase of a call with exercise price X_2 and the sale of a call with exercise price X_1, with X_2 greater than X_1. Graph the payoff to this strategy and compare it to Figure 20.11.
8. Joseph Jones, a manager at Computer Science, Inc. (CSI), received 10,000 shares of company stock as part of his compensation package. The stock currently sells at \$40 a share. Joseph would like to defer selling the stock until the next tax year. In January, however, he will need to sell all his holdings to provide for a down payment on his new house. Joseph is worried about the price risk involved in keeping his shares. At current prices, he would receive \$400,000 for the stock. If the value of his stock holdings falls below \$350,000, his ability to come up with the necessary down payment would be jeopardized. On the other hand, if the stock value rises to \$450,000, he would be able to maintain a small cash reserve even after making the down payment. Joseph considers three investment strategies:
   a. Strategy A is to write January call options on the CSI shares with strike price \$45. These calls are currently selling for \$3 each.

b. Strategy B is to buy January put options on CSI with strike price $35. These options also sell for $3 each.

c. Strategy C is to establish a zero-cost collar by writing the January calls and buying the January puts.

Evaluate each of these strategies with respect to Joseph's investment goals. What are the advantages and disadvantages of each? Which would you recommend?

9. You are attempting to formulate an investment strategy. On the one hand, you think there is great upward potential in the stock market and would like to participate in the upward move if it materializes. However, you are not able to afford substantial stock market losses and so cannot run the risk of a stock market collapse, which you think is also a possibility. Your investment adviser suggests a protective put position: Buy both shares in a market index stock fund and put options on those shares with 3-month maturity and exercise price of $780. The stock index fund is currently selling for $900. However, your uncle suggests you instead buy a 3-month call option on the index fund with exercise price $840 and buy 3-month T-bills with face value $840.

a. On the same graph, draw the *payoffs* to each of these strategies as a function of the stock fund value in 3 months. (Hint: Think of the options as being on one "share" of the stock index fund, with the current price of each share of the fund equal to $900.)

b. Which portfolio must require a greater initial outlay to establish? (Hint: Does either portfolio provide a final payout that is always at least as great as the payoff of the other portfolio?)

c. Suppose the market prices of the securities are as follows:

Stock fund	$900
T-bill (face value $840)	$810
Call (exercise price $840)	$120
Put (exercise price $780)	$ 6

Make a table of the profits realized for each portfolio for the following values of the stock price in 3 months: S_T = $700, $840, $900, $960.

Graph the profits to each portfolio as a function of S_T on a single graph.

d. Which strategy is riskier? Which should have a higher beta?

e. Explain why the data for the securities given in part (*c*) do *not* violate the put-call parity relationship.

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10. Donna Donie, CFA, has a client who believes the common stock price of TRT Materials (currently $58 per share) could move substantially in either direction in reaction to an expected court decision involving the company. The client currently owns no TRT shares, but asks Donie for advice about implementing a strangle strategy to capitalize on the possible stock price movement. A strangle is a portfolio of a put and a call with different exercise prices but the same expiration date. Donie gathers the TRT option-pricing data:

Characteristic	Call Option	Put Option
Price	$ 5	$ 4
Strike Price	$60	$55
Time to expiration	90 days from now	90 days from now

a. Recommend whether Donie should choose a long strangle strategy or a short strangle strategy to achieve the client's objective.

b. Calculate, at expiration for the appropriate strangle strategy in part (*a*), the:

i. Maximum possible loss per share.

ii. Maximum possible gain per share.

iii. Breakeven stock price(s).

11. Use the spreadsheet from the Excel Application boxes on spreads and straddles (available at **www.mhhe.com/bkm**; link to Chapter 20 material) to answer these questions.
    a. Plot the payoff and profit diagrams to a straddle position with an exercise (strike) price of $130. Assume the options are priced as they are in the Excel Application.
    b. Plot the payoff and profit diagrams to a bullish spread position with exercise (strike) prices of $120 and $130. Assume the options are priced as they are in the Excel Application.

eXcel
Please visit us at www.mhhe.com/bkm

12. The agricultural price support system guarantees farmers a minimum price for their output. Describe the program provisions as an option. What is the asset? The exercise price?
13. In what ways is owning a corporate bond similar to writing a put option? A call option?
14. An executive compensation scheme might provide a manager a bonus of $1,000 for every dollar by which the company's stock price exceeds some cutoff level. In what way is this arrangement equivalent to issuing the manager call options on the firm's stock?
15. Martin Bowman is preparing a report distinguishing traditional debt securities from structured note securities. Discuss how the following structured note securities differ from a traditional debt security with respect to coupon and principal payments:
    i. Equity index-linked notes.
    ii. Commodity-linked bear bond.

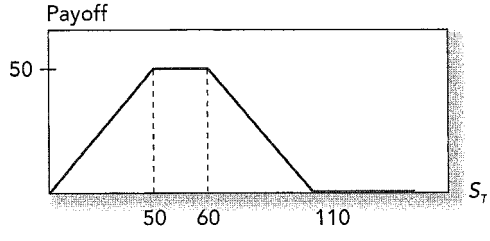
CFA® PROBLEMS

16. Consider the following options portfolio. You write an April expiration call option on IBM with exercise price 85. You write an April IBM put option with exercise price 80.
    a. Graph the payoff of this portfolio at option expiration as a function of IBM's stock price at that time.
    b. What will be the profit/loss on this position if IBM is selling at 83 on the option maturity date? What if IBM is selling at 90? Use *The Wall Street Journal* listing from Figure 20.1 to answer this question.
    c. At what two stock prices will you just break even on your investment?
    d. What kind of "bet" is this investor making; that is, what must this investor believe about IBM's stock price to justify this position?
17. Consider the following portfolio. You write a put option with exercise price 90 and buy a put option on the same stock with the same maturity date with exercise price 95.
    a. Plot the value of the portfolio at the maturity date of the options.
    b. On the same graph, plot the profit of the portfolio. Which option must cost more?
18. A Ford put option with strike price 60 trading on the Acme options exchange sells for $2. To your amazement, a Ford put with the same maturity selling on the Apex options exchange but with strike price 62 also sells for $2. If you plan to hold the options positions to maturity, devise a zero-net-investment arbitrage strategy to exploit the pricing anomaly. Draw the profit diagram at maturity for your position.
19. Using the IBM option prices in Figure 20.1, calculate the market price of a riskless zero-coupon bond with face value $85 that matures in April on the same date as the listed options.
20. You buy a share of stock, write a 1-year call option with $X = \$10$, and buy a 1-year put option with $X = \$10$. Your net outlay to establish the entire portfolio is $9.50. What is the risk-free interest rate? The stock pays no dividends.
21. Demonstrate that an at-the-money call option on a given stock must cost more than an at-the-money put option on that stock with the same maturity. The stock will pay no dividends until after the expiration date. (Hint: Use put-call parity.)
22. You write a put option with $X = 100$ and buy a put with $X = 110$. The puts are on the same stock and have the same maturity date.
    a. Draw the payoff graph for this strategy.
    b. Draw the profit graph for this strategy.
    c. If the underlying stock has positive beta, does this portfolio have positive or negative beta?

23. Joe Finance has just purchased a stock index fund, currently selling at $400 per share. To protect against losses, Joe also purchased an at-the-money European put option on the fund for $20, with exercise price $400, and 3-month time to expiration. Sally Calm, Joe's financial adviser, points out that Joe is spending a lot of money on the put. She notes that 3-month puts with strike prices of $390 cost only $15, and suggests that Joe use the cheaper put.
    a. Analyze Joe's and Sally's strategies by drawing the *profit* diagrams for the stock-plus-put positions for various values of the stock fund in 3 months.
    b. When does Sally's strategy do better? When does it do worse?
    c. Which strategy entails greater systematic risk?

24. You write a call option with $X = 50$ and buy a call with $X = 60$. The options are on the same stock and have the same maturity date. One of the calls sells for $3; the other sells for $9.
    a. Draw the payoff graph for this strategy at the option maturity date.
    b. Draw the profit graph for this strategy.
    c. What is the break-even point for this strategy? Is the investor bullish or bearish on the stock?

25. Devise a portfolio using only call options and shares of stock with the following value (payoff) at the option maturity date. If the stock price is currently 53, what kind of bet is the investor making?



CFA® PROBLEMS

26. Suresh Singh, CFA, is analyzing a convertible bond. The characteristics of the bond and the underlying common stock are given in the following exhibit:

Convertible Bond Characteristics	
Par value	$1,000
Annual coupon rate (annual pay)	6.5%
Conversion ratio	22
Market price	105% of par value
Straight value	99% of par value
Underlying Stock Characteristics	
Current market price	$40 per share
Annual cash dividend	$1.20 per share

Compute the bond's:
    i. Conversion value.
    ii. Market conversion price.

CFA® PROBLEMS

27. Rich McDonald, CFA, is evaluating his investment alternatives in Ytel Incorporated by analyzing a Ytel convertible bond and Ytel common equity. Characteristics of the two securities are given in the following exhibit:

Characteristics	Convertible Bond	Common Equity
Par value	$1,000	—
Coupon (annual payment)	4%	—
Current market price	$980	$35 per share
Straight bond value	$925	—
Conversion ratio	25	—
Conversion option	At any time	—
Dividend	—	$0
Expected market price in 1 year	$1,125	$45 per share

a. Calculate, based on the exhibit, the:

i. Current market conversion price for the Ytel convertible bond.
ii. Expected 1-year rate of return for the Ytel convertible bond.
iii. Expected 1-year rate of return for the Ytel common equity.

One year has passed and Ytel's common equity price has increased to $51 per share. Also, over the year, the interest rate on Ytel's nonconvertible bonds of the same maturity increased, while credit spreads remained unchanged.

b. Name the two components of the convertible bond's value. Indicate whether the value of each component should decrease, stay the same, or increase in response to the:

i. Increase in Ytel's common equity price.
ii. Increase in interest rates.

28. The following questions appeared in past CFA Level I examinations.

CFA® PROBLEMS

a. Consider a bullish spread option strategy using a call option with a $25 exercise price priced at $4 and a call option with a $40 exercise price priced at $2.50. If the price of the stock increases to $50 at expiration and each option is exercised on the expiration date, the net profit per share at expiration (ignoring transaction costs) is:

i. $8.50
ii. $13.50
iii. $16.50
iv. $23.50

b. A put on XYZ stock with a strike price of $40 is priced at $2.00 per share, while a call with a strike price of $40 is priced at $3.50. What is the maximum per-share loss to the writer of the uncovered put and the maximum per-share gain to the writer of the uncovered call?

	Maximum Loss to Put Writer	Maximum Gain to Call Writer
i.	$38.00	$ 3.50
ii.	$38.00	$36.50
iii.	$40.00	$ 3.50
iv.	$40.00	$40.00

SOLUTIONS TO CONCEPT CHECKS

1. *a.* Denote the stock price at option expiration by S_T, and the exercise price by X. Value at expiration $= S_T - X = S_T - \$85$ if this value is positive; otherwise the call expires worthless.
Profit = Final value − Price of call option = Proceeds − $.95.

www.optionstrategist.com/free/analysis/calcs/index.html
www.schaeffersresearch.com
www.optionsxpress.com
www.fintools.com/?calculators.html
These sites offer options analysis and calculators.

www.optionanimation.com
This site offers graphical analysis of the Black-Scholes model and an implied volatility calculator.

E-Investments

Option Price Differences

Select a stock for which options are listed on the CBOE Web site (**www.cboe.com**). The price data for captions can be found on the "delayed quotes" menu option of the CBOE Web site. Enter a ticker symbol for a stock of your choice and pull up its option price data.

Using daily price data from one of the Web sites noted in the text book, calculate the annualized standard deviation of the daily percentage change in the stock price. Create a Black-Scholes option-pricing model in a spreadsheet, or use our Spreadsheet 21.1, available at **www.mhhe.com/bkm** with Chapter 21 material. Using the standard deviation and a risk-free rate found at **www.bloomberg.com/markets/rates/index.html**, calculate the value of the call options.

How do the calculated values compare to the market prices of the options? On the basis of the difference between the price you calculated using historical volatility and the actual price of the option, what do you conclude about expected trends in market volatility?

STANDARD &POOR'S

Option traders love stock volatility. (Why?) From the Market Insight entry page (**www.mhhe.com/edumarketinsight**), link to *Industry*, then locate the Airlines industry. Review the *Industry Profile* for a measure of recent stock price volatility. Are airline companies' prices more or less volatile than the market in general, as measured by the S&P 500? Next review the S&P Industry Survey for the airlines industry. What factors associated with the industry have produced the recent stock price volatility? Do a similar analysis for the Regional Banks industry. How does its volatility compare to that of the Airlines industry? Are the results what you expected? Why? In the Black-Scholes valuation model, how is volatility associated with option value? What options strategies exploit volatility?

PROBLEMS

1. We showed in the text that the value of a call option increases with the volatility of the stock. Is this also true of put option values? Use the put-call parity theorem as well as a numerical example to prove your answer.
2. In each of the following questions, you are asked to compare two options with parameters as given. The risk-free interest rate for *all* cases should be assumed to be 6%. Assume the stocks on which these options are written pay no dividends.

   a.

Put	T	X	σ	Price of Option
A	.5	50	.20	$10
B	.5	50	.25	$10

   Which put option is written on the stock with the lower price?

   i. A.
   ii. B.
   iii. Not enough information.

b.

Put	T	X	σ	Price of Option
A	.5	50	.2	$10
B	.5	50	.2	$12

Which put option must be written on the stock with the lower price?

i. A.
ii. B.
iii. Not enough information.

c.

Call	S	X	σ	Price of Option
A	50	50	.20	$12
B	55	50	.20	$10

Which call option must have the lower time to maturity?

i. A.
ii. B.
iii. Not enough information.

d.

Call	T	X	S	Price of Option
A	.5	50	55	$10
B	.5	50	55	$12

Which call option is written on the stock with higher volatility?

i. A.
ii. B.
iii. Not enough information.

e.

Call	T	X	S	Price of Option
A	.5	50	55	$10
B	.5	50	55	$ 7

Which call option is written on the stock with higher volatility?

i. A.
ii. B.
iii. Not enough information.

3. Reconsider the determination of the hedge ratio in the two-state model (page 745), where we showed that one-third share of stock would hedge one option. What is the hedge ratio at the following exercise prices: 115, 100, 75, 50, 25, 10? What do you conclude about the hedge ratio as the option becomes progressively more in the money?

4. Show that Black-Scholes call option hedge ratios also increase as the stock price increases. Consider a 1-year option with exercise price $50, on a stock with annual standard deviation 20%. The T-bill rate is 8% per year. Find $N(d_1)$ for stock prices $45, $50, and $55.

5. We will derive a two-state put option value in this problem. Data: $S_0 = 100$; $X = 110$; $1 + r = 1.10$. The two possibilities for S_T are 130 and 80.
   a. Show that the range of S is 50, whereas that of P is 30 across the two states. What is the hedge ratio of the put?
   b. Form a portfolio of three shares of stock and five puts. What is the (nonrandom) payoff to this portfolio? What is the present value of the portfolio?
   c. Given that the stock currently is selling at 100, solve for the value of the put.

6. Calculate the value of a call option on the stock in the previous problem with an exercise price of 110. Verify that the put-call parity theorem is satisfied by your answers to Problems 5 and 6.

(Do not use continuous compounding to calculate the present value of X in this example because we are using a two-state model here, not a continuous-time Black-Scholes model.)

7. Use the Black-Scholes formula to find the value of a call option on the following stock:

Time to maturity	6 months
Standard deviation	50% per year
Exercise price	$50
Stock price	$50
Interest rate	10%

8. Find the Black-Scholes value of a put option on the stock in the previous problem with the same exercise price and maturity as the call option.
9. Recalculate the value of the call option in Problem 7, successively substituting one of the changes below while keeping the other parameters as in Problem 7:

   a. Time to maturity = 3 months.
   b. Standard deviation = 25% per year.
   c. Exercise price = $55.
   d. Stock price = $55.
   e. Interest rate = 15%.

   Consider each scenario independently. Confirm that the option value changes in accordance with the prediction of Table 21.1.
10. A call option with $X = \$50$ on a stock currently priced at $S = \$55$ is selling for $10. Using a volatility estimate of $\sigma = .30$, you find that $N(d_1) = .6$ and $N(d_2) = .5$. The risk-free interest rate is zero. Is the implied volatility based on the option price more or less than .30? Explain.
11. What would be the Excel formula in Spreadsheet 21.1 for the Black-Scholes value of a straddle position?
12. Would you expect a $1 increase in a call option's exercise price to lead to a decrease in the option's value of more or less than $1?
13. Is a put option on a high-beta stock worth more than one on a low-beta stock? The stocks have identical firm-specific risk.
14. All else equal, is a call option on a stock with a lot of firm-specific risk worth more than one on a stock with little firm-specific risk? The betas of the two stocks are equal.
15. All else equal, will a call option with a high exercise price have a higher or lower hedge ratio than one with a low exercise price?
16. Should the rate of return of a call option on a long-term Treasury bond be more or less sensitive to changes in interest rates than is the rate of return of the underlying bond?
17. If the stock price falls and the call price rises, then what has happened to the call option's implied volatility?
18. If the time to maturity falls and the put price rises, then what has happened to the put option's implied volatility?
19. According to the Black-Scholes formula, what will be the value of the hedge ratio of a call option as the stock price becomes infinitely large? Explain briefly.
20. According to the Black-Scholes formula, what will be the value of the hedge ratio of a put option for a very small exercise price?
21. The hedge ratio of an at-the-money call option on IBM is .4. The hedge ratio of an at-the-money put option is −.6. What is the hedge ratio of an at-the-money straddle position on IBM?
22. Consider a 6-month expiration European call option with exercise price $105. The underlying stock sells for $100 a share and pays no dividends. The risk-free rate is 5%. What is the implied volatility of the option if the option currently sells for $8? Use Spreadsheet 21.1 (available at **www.mhhe.com/bkm;** link to Chapter 21 material) to answer this question.

eXcel
Please visit us at www.mhhe.com/bkm

a. Go to the Tools menu of the spreadsheet and select Goal Seek. The dialogue box will ask you for three pieces of information. In that dialogue box, you should *set cell* E6 *to value* 8 *by changing cell* B2. In other words, you ask the spreadsheet to find the value of standard deviation (which appears in cell B2) that forces the value of the option (in cell E6) equal to $8. Then click OK, and you should find that the call is now worth $8, and the entry for standard deviation has been changed to a level consistent with this value. This is the call's implied standard deviation at a price of $8.

b. What happens to implied volatility if the option is selling at $9? Why has implied volatility increased?

c. What happens to implied volatility if the option price is unchanged at $8, but option maturity is lower, say only 4 months? Why?

d. What happens to implied volatility if the option price is unchanged at $8, but the exercise price is lower, say only $100? Why?

e. What happens to implied volatility if the option price is unchanged at $8, but the stock price is lower, say only $98? Why?

23. A collar is established by buying a share of stock for $50, buying a 6-month put option with exercise price $45, and writing a 6-month call option with exercise price $55. Based on the volatility of the stock, you calculate that for a strike price of $45 and maturity of 6 months, $N(d_1) = .60$, whereas for the exercise price of $55, $N(d_1) = .35$.

a. What will be the gain or loss on the collar if the stock price increases by $1?

b. What happens to the delta of the portfolio if the stock price becomes very large? Very small?

CFA® PROBLEMS

24. The board of directors of Abco Company is concerned about the downside risk of a $100 million equity portfolio in its pension plan. The board's consultant has proposed temporarily (for 1 month) hedging the portfolio with either futures or options. Referring to the following table, the consultant states:

a. "The $100 million equity portfolio can be fully protected on the downside by selling (shorting) 2,000 futures contracts."

b. "The cost of this protection is that the portfolio's expected rate of return will be zero percent."

Market, Portfolio, and Contract Data

Equity index level	99.00
Equity futures price	100.00
Futures contract multiplier	500
Portfolio beta	1.20
Contract expiration (months)	3

Critique the accuracy of each of the consultant's two statements.

25. These three put options are all written on the same stock. One has a delta of −.9, one a delta of −.5, and one a delta of −.1. Assign deltas to the three puts by filling in this table.

Put	X	Delta
A	10	
B	20	
C	30	

26. You are *very* bullish (optimistic) on stock EFG, much more so than the rest of the market. In each question, choose the portfolio strategy that will give you the biggest dollar profit if your bullish forecast turns out to be correct. Explain your answer.

a. Choice A: $10,000 invested in calls with $X = 50$.
Choice B: $10,000 invested in EFG stock.

b. *Choice A:* 10 call option contracts (for 100 shares each), with $X = 50$.
Choice B: 1,000 shares of EFG stock.

27. Michael Weber, CFA, is analyzing several aspects of option valuation, including the determinants of the value of an option, the characteristics of various models used to value options, and the potential for divergence of calculated option values from observed market prices.

CFA® PROBLEMS

a. What is the expected effect on the value of a call option on common stock if the volatility of the underlying stock price decreases? If the time to expiration of the option increases?
b. Using the Black-Scholes option-pricing model, Weber calculates the price of a 3-month call option and notices the option's calculated value is different from its market price. With respect to Weber's use of the Black-Scholes option-pricing model,

i. Discuss why the calculated value of an out-of-the-money European option may differ from its market price.
ii. Discuss why the calculated value of an American option may differ from its market price.

28. Imagine you are a provider of portfolio insurance. You are establishing a 4-year program. The portfolio you manage is currently worth $100 million, and you hope to provide a minimum return of 0%. The equity portfolio has a standard deviation of 25% per year, and T-bills pay 5% per year. Assume for simplicity that the portfolio pays no dividends (or that all dividends are reinvested).

a. How much should be placed in bills? How much in equity?
b. What should the manager do if the stock portfolio falls by 3% on the first day of trading?

29. Joel Franklin is a portfolio manager responsible for derivatives. Franklin observes an American-style option and a European-style option with the same strike price, expiration, and underlying stock. Franklin believes that the European-style option will have a higher premium than the American-style option.

CFA® PROBLEMS

a. Critique Franklin's belief that the European-style option will have a higher premium.
Franklin is asked to value a 1-year European-style call option for Abaco Ltd. common stock, which last traded at $43.00. He has collected the information in the following table.

Closing stock price	$43.00
Call and put option exercise price	45.00
1-year put option price	4.00
1-year Treasury bill rate	5.50%
Time to expiration	One year

b. Calculate, using put-call parity and the information provided in the table, the European-style call option value.
c. State the effect, if any, of each of the following three variables on the value of a call option. (No calculations required.)

i. An increase in short-term interest rate.
ii. An increase in stock price volatility.
iii. A decrease in time to option expiration.

30. You would like to be holding a protective put position on the stock of XYZ Co. to lock in a guaranteed minimum value of $100 at year-end. XYZ currently sells for $100. Over the next year the stock price will increase by 10% or decrease by 10%. The T-bill rate is 5%. Unfortunately, no put options are traded on XYZ Co.

a. Suppose the desired put option were traded. How much would it cost to purchase?
b. What would have been the cost of the protective put portfolio?

c. What portfolio position in stock and T-bills will ensure you a payoff equal to the payoff that would be provided by a protective put with $X = 100$? Show that the payoff to this portfolio and the cost of establishing the portfolio matches that of the desired protective put.

31. Return to Example 21.1. Use the binomial model to value a 1-year European put option with exercise price \$110 on the stock in that example. Does your solution for the put price satisfy put-call parity?

CFA® PROBLEMS

32. A stock index is currently trading at 50. Paul Tripp, CFA, wants to value 2-year index options using the binomial model. The stock will either increase in value by 20% or fall in value by 20%. The annual risk-free interest rate is 6%. No dividends are paid on any of the underlying securities in the index.

a. Construct a two-period binomial tree for the value of the stock index.
b. Calculate the value of a European call option on the index with an exercise price of 60.
c. Calculate the value of a European put option on the index with an exercise price of 60.
d. Confirm that your solutions for the values of the call and the put satisfy put-call parity.

33. Suppose that the risk-free interest rate is zero. Would an American put option ever be exercised early? Explain.

34. Let $p(S, T, X)$ denote the value of a European put on a stock selling at S dollars, with time to maturity T, and with exercise price X, and let $P(S, T, X)$ be the value of an American put.

a. Evaluate $p(0, T, X)$.
b. Evaluate $P(0, T, X)$.
c. Evaluate $p(S, T, 0)$.
d. Evaluate $P(S, T, 0)$.
e. What does your answer to (*b*) tell you about the possibility that American puts may be exercised early?

35. You are attempting to value a call option with an exercise price of \$100 and 1 year to expiration. The underlying stock pays no dividends, its current price is \$100, and you believe it has a 50% chance of increasing to \$120 and a 50% chance of decreasing to \$80. The risk-free rate of interest is 10%. Calculate the call option's value using the two-state stock price model.

36. Consider an increase in the volatility of the stock in the previous problem. Suppose that if the stock increases in price, it will increase to \$130, and that if it falls, it will fall to \$70. Show that the value of the call option is now higher than the value derived in the previous problem.

37. Calculate the value of a put option with exercise price \$100 using the data in Problem 35. Show that put-call parity is satisfied by your solution.

38. XYZ Corp. will pay a \$2 per share dividend in 2 months. Its stock price currently is \$60 per share. A call option on XYZ has an exercise price of \$55 and 3-month time to maturity. The risk-free interest rate is .5% per month, and the stock's volatility (standard deviation) = 7% per month. Find the pseudo-American option value. (Hint: Try defining one "period" as a month, rather than as a year.)

CFA® PROBLEMS

39. Ken Webster manages a \$100 million equity portfolio benchmarked to the S&P 500 index. Over the past 2 years, the S&P 500 index has appreciated 60 percent. Webster believes the market is overvalued when measured by several traditional fundamental/economic indicators. He is concerned about maintaining the excellent gains the portfolio has experienced in the past 2 years but recognizes that the S&P 500 index could still move above its current 668 level.

Webster is considering the following *option collar* strategy:

- Protection for the portfolio can be attained by purchasing an S&P 500 index put with a strike price of 665 (just out of the money).
- The put can be financed by selling two 675 calls (farther out-of-the-money) for every put purchased.
- Because the combined delta of the two calls (see following table) is less than 1 (that is, $2 \times 0.36 = 0.72$) the options will not lose more than the underlying portfolio will gain if the market advances.

The information in the following table describes the two options used to create the collar.

Characteristics	675 Call	665 Put
Option price	$4.30	$8.05
Option implied volatility	11.00%	14.00%
Option's delta	0.36	−0.44
Contracts needed for collar	602	301

Notes:
- Ignore transaction costs.
- S&P 500 historical 30-day volatility = 12.00%.
- Time to option expiration = 30 days.

a. Describe the potential returns of the combined portfolio (the underlying portfolio plus the option collar) if after 30 days the S&P 500 index has:
   i. risen approximately 5% to 701.
   ii. remained at 668 (no change).
   iii. declined by approximately 5% to 635.
   (No calculations are necessary.)

b. Discuss the effect on the hedge ratio (delta) of *each* option as the S&P 500 approaches the level for *each* of the potential outcomes listed in part (*a*).

c. Evaluate the pricing of *each* of the following in relation to the volatility data provided:
   i. the put
   ii. the call

40. "The beta of a call option on General Motors is greater than the beta of a share of General Motors." True or false?

41. "The beta of a call option on the S&P 500 index with an exercise price of 1,030 is greater than the beta of a call on the index with an exercise price of 1,040." True or false?

42. What will happen to the hedge ratio of a convertible bond as the stock price becomes very large?

43. Salomon Brothers believes that market volatility will be 20% annually for the next 3 years. Three-year at-the-money call and put options on the market index sell at an implied volatility of 22%. What options portfolio can Salomon Brothers establish to speculate on its volatility belief without taking a bullish or bearish position on the market? Using Salomon's estimate of volatility, 3-year at-the-money options have $N(d_1) = .6$.

44. Suppose that call options on ExxonMobil stock with time to maturity 3 months and strike price $60 are selling at an implied volatility of 30%. ExxonMobil stock currently is $60 per share, and the risk-free rate is 4%. If you believe the true volatility of the stock is 32%, how can you trade on your belief without taking on exposure to the performance of ExxonMobil? How many shares of stock will you hold for each option contract purchased or sold?

45. Using the data in Problem 44, suppose that 3-month put options with a strike price of $60 are selling at an implied volatility of 34%. Construct a delta-neutral portfolio comprising positions in calls and puts that will profit when the option prices come back into alignment.

46. Suppose that Salomon Brothers sells call options on $1.25 million worth of a stock portfolio with beta = 1.5. The option delta is .8. It wishes to hedge out its resultant exposure to a market advance by buying a market index portfolio.

   a. How many dollars worth of the market index portfolio should Salomon Brothers purchase to hedge its position?

   b. What if Salomon instead uses market index puts to hedge its exposure? Should it buy or sell puts? Each put option is on 100 units of the index, and the index at current prices represents $1,000 worth of stock.

47. You are holding call options on a stock. The stock's beta is .75, and you are concerned that the stock market is about to fall. The stock is currently selling for $5 and you hold 1 million options

on the stock (i.e., you hold 10,000 contracts for 100 shares each). The option delta is .8. How much of the market index portfolio must you buy or sell to hedge your market exposure?

SOLUTIONS TO CONCEPT CHECKS

1.

If This Variable Increases . . .	The Value of a Put Option
S	Decreases
X	Increases
σ	Increases
T	Increases*
r_f	Decreases
Dividend payouts	Increases

*For American puts, increase in time to expiration must increase value. One can always choose to exercise early if this is optimal; the longer expiration date simply expands the range of alternatives open to the option holder which must make the option more valuable. For a European put, where early exercise is not allowed, longer time to expiration can have an indeterminate effect. Longer maturity increases volatility value since the final stock price is more uncertain, but it reduces the present value of the exercise price that will be received if the put is exercised. The net effect on put value is ambiguous.

To understand the impact of higher volatility, consider the same scenarios as for the call. The low volatility scenario yields a lower expected payoff.

High volatility	Stock price	$10	$20	$30	$40	$50
	Put payoff	$20	$10	$ 0	$ 0	$ 0
Low volatility	Stock price	$20	$25	$30	$35	$40
	Put payoff	$10	$ 5	$ 0	$ 0	$ 0

2. The parity relationship assumes that all options are held until expiration and that there are no cash flows until expiration. These assumptions are valid only in the special case of European options on non-dividend-paying stocks. If the stock pays no dividends, the American and European calls are equally valuable, whereas the American put is worth more than the European put. Therefore, although the parity theorem for European options states that

$$P = C - S_0 + \text{PV}(X)$$

in fact, P will be *greater* than this value if the put is American.

3. Because the option now is underpriced, we want to reverse our previous strategy.

		Cash Flow in 1 Year for Each Possible Stock Price	
	Initial Cash Flow	$S = 90$	$S = 120$
Buy 3 options	−16.50	0	30
Short-sell 1 share; repay in 1 year	100	−90	−120
Lend $83.50 at 10% interest rate	−83.50	91.85	91.85
TOTAL	0	1.85	1.85

The riskless cash flow in 1 year per option is $1.85/3 = $.6167, and the present value is $.6167/1.10 = $.56, precisely the amount by which the option is underpriced.

4. *a.* $C_u - C_d = \$6.984 - 0$
   b. $uS_0 - dS_0 = \$110 - \$95 = \$15$
   c. 6.984/15 = .4656

Contract Specifications for Financial Futures and Options

Go to the Chicago Mercantile Exchange site at **www.cme.com**. In the *Quick links* section, select *Contract Specifications*, and follow the link for *CME Equity* futures. Answer the folowing questions about the CME E-mini Russell 2000 futures contract:

1. What is the trading unit for the futures contract?
2. What is the settlement method for the futures contract?
3. For what months are the futures contracts available?
4. What is the 10% limit for the futures contracts? Click on the *Equity limits* link to find the *Price Limit Guide* and locate the E-mini Russell 2000 contract. Click on the *10% Limit* link at the top of the column for a description of what the limit means.
5. When is the next futures contract scheduled to be added?

E-Investments

From the Market Insight entry page (**www.mhhe.com/edumarketinsight**), link to *Industry*, then locate the Airlines industry. Open the S&P Industry Survey for Airlines and review the *Current Environment* and the *Industry Profile* sections. What futures contracts might this industry use to hedge its risk? Where are these contracts traded? For information on these markets see **www.nymex.com.**

STANDARD &POOR'S

PROBLEMS

1. *a.* Turn to Figure 22.1. If the margin requirement is 10% of the futures price times the multiplier of $250, how much must you deposit with your broker to trade the June maturity S&P 500 contract?
   b. If the June futures price were to increase to 1,320, what percentage return would you earn on your net investment if you entered the long side of the contract at the price shown in the figure?
   c. If the June futures price falls by 1%, what is your percentage return?
2. Why is there no futures market in cement?
3. Why might individuals purchase futures contracts rather than the underlying asset?
4. What is the difference in cash flow between short-selling an asset and entering a short futures position?
5. Are the following statements true or false? Why?
   a. All else equal, the futures price on a stock index with a high dividend yield should be higher than the futures price on an index with a low dividend yield.
   b. All else equal, the futures price on a high-beta stock should be higher than the futures price on a low-beta stock.
   c. The beta of a short position in the S&P 500 futures contract is negative.
6. *a.* A single-stock futures contract on a non-dividend-paying stock with current price $150 has a maturity of 1 year. If the T-bill rate is 6%, what should the futures price be?
   b. What should the futures price be if the maturity of the contract is 3 years?
   c. What if the interest rate is 8% and the maturity of the contract is 3 years?
7. Your analysis leads you to believe the stock market is about to rise substantially. The market is unaware of this situation. What should you do?
8. How might a portfolio manager use financial futures to hedge risk in each of the following circumstances:
   a. You own a large position in a relatively illiquid bond that you want to sell.

b. You have a large gain on one of your Treasuries and want to sell it, but you would like to defer the gain until the next tax year.

c. You will receive your annual bonus next month that you hope to invest in long-term corporate bonds. You believe that bonds today are selling at quite attractive yields, and you are concerned that bond prices will rise over the next few weeks.

9. Suppose the value of the S&P 500 stock index is currently 1,300. If the 1-year T-bill rate is 6% and the expected dividend yield on the S&P 500 is 2%, what should the 1-year maturity futures price be?

10. Consider a stock that pays no dividends on which a futures contract, a call option, and a put option trade. The maturity date for all three contracts is T, the exercise price of the put and the call are both X, and the futures price is F. Show that if $X = F$, then the call price equals the put price. Use parity conditions to guide your demonstration.

11. It is now January. The current interest rate is 5%. The June futures price for gold is \$546.30, whereas the December futures price is \$560.00. Is there an arbitrage opportunity here? If so, how would you exploit it?

CFA® PROBLEMS

12. Joan Tam, CFA, believes she has identified an arbitrage opportunity for a commodity as indicated by the information given in the following exhibit:

Spot price for commodity	\$120
Futures price for commodity expiring in 1 year	\$125
Interest rate for 1 year	8%

a. Describe the transactions necessary to take advantage of this specific arbitrage opportunity.

b. Calculate the arbitrage profit.

13. OneChicago has just introduced a single-stock futures contract on Brandex stock, a company that currently pays no dividends. Each contract calls for delivery of 1,000 shares of stock in 1 year. The T-bill rate is 6% per year.

a. If Brandex stock now sells at \$120 per share, what should the futures price be?

b. If the Brandex price drops by 3%, what will be the change in the futures price and the change in the investor's margin account?

c. If the margin on the contract is \$12,000, what is the percentage return on the investor's position?

14. The multiplier for a futures contract on the stock market index is \$250. The maturity of the contract is 1 year, the current level of the index is 1,000, and the risk-free interest rate is .5% per month. The dividend yield on the index is .2% per month. Suppose that after 1 month, the stock index is at 1,020.

a. Find the cash flow from the mark-to-market proceeds on the contract. Assume that the parity condition always holds exactly.

b. Find the holding-period return if the initial margin on the contract is \$15,000.

CFA® PROBLEMS

15. Michelle Industries issued a Swiss franc–denominated 5-year discount note for SFr200 million. The proceeds were converted to U.S. dollars to purchase capital equipment in the United States. The company wants to hedge this currency exposure and is considering the following alternatives:

- At-the-money Swiss franc call options.
- Swiss franc forwards.
- Swiss franc futures.

a. Contrast the essential characteristics of each of these three derivative instruments.

b. Evaluate the suitability of each in relation to Michelle's hedging objective, including both advantages and disadvantages.

16. You are a corporate treasurer who will purchase \$1 million of bonds for the sinking fund in 3 months. You believe rates will soon fall, and you would like to repurchase the company's sinking fund bonds (which currently are selling below par) in advance of requirements. Unfortunately, you must obtain approval from the board of directors for such a purchase, and

this can take up to 2 months. What action can you take in the futures market to hedge any adverse movements in bond yields and prices until you can actually buy the bonds? Will you be long or short? Why? A qualitative answer is fine.

17. Identify the fundamental distinction between a futures contract and an option contract, and briefly explain the difference in the manner that futures and options modify portfolio risk.

CFA® PROBLEMS

18. The S&P portfolio pays a dividend yield of 1% annually. Its current value is 1,300. The T-bill rate is 4%. Suppose the S&P futures price for delivery in 1 year is 1,330. Construct an arbitrage strategy to exploit the mispricing and show that your profits 1 year hence will equal the mispricing in the futures market.

CFA® PROBLEMS

19. Maria VanHusen, CFA, suggests that using forward contracts on fixed income securities can be used to protect the value of the Star Hospital Pension Plan's bond portfolio against the possibility of rising interest rates. VanHusen prepares the following example to illustrate how such protection would work:

- A 10-year bond with a face value of $1,000 is issued today at par value. The bond pays an annual coupon.
- An investor intends to buy this bond today and sell it in 6 months.
- The 6-month risk-free interest rate today is 5.00% (annualized).
- A 6-month forward contract on this bond is available, with a forward price of $1,024.70.
- In 6 months, the price of the bond, including accrued interest, is forecast to fall to $978.40 as a result of a rise in interest rates.

a. State whether the investor should buy or sell the forward contract to protect the value of the bond against rising interest rates during the holding period.
b. Calculate the value of the forward contract for the investor at the maturity of the forward contract if VanHusen's bond-price forecast turns out to be accurate.
c. Calculate the change in value of the combined portfolio (the underlying bond and the appropriate forward contract position) 6 months after contract initiation.

20. Sandra Kapple asks Maria VanHusen about using futures contracts to protect the value of the Star Hospital Pension Plan's bond portfolio if interest rates rise. VanHusen states:

CFA® PROBLEMS

a. "Selling a bond futures contract will generate positive cash flow in a rising interest rate environment prior to the maturity of the futures contract."
b. "The cost of carry causes bond futures contracts to trade for a higher price than the spot price of the underlying bond prior to the maturity of the futures contract."

Comment on the accuracy of each of VanHusen's two statements.

21. *a.* How should the parity condition (Equation 22.2) for stocks be modified for futures contracts on Treasury bonds? What should play the role of the dividend yield in that equation?
b. In an environment with an upward-sloping yield curve, should T-bond futures prices on more-distant contracts be higher or lower than those on near-term contracts?
c. Confirm your intuition by examining Figure 22.1.

22. Consider this arbitrage strategy to derive the parity relationship for spreads: (1) enter a long futures position with maturity date T_1 and futures price $F(T_1)$; (2) enter a short position with maturity T_2 and futures price $F(T_2)$; (3) at T_1, when the first contract expires, buy the asset and borrow $F(T_1)$ dollars at rate r_f; (4) pay back the loan with interest at time T_2.

a. What are the total cash flows to this strategy at times 0, T_1, and T_2?
b. Why must profits at time T_2 be zero if no arbitrage opportunities are present?
c. What must the relationship between $F(T_1)$ and $F(T_2)$ be for the profits at T_2 to be equal to zero? This relationship is the parity relationship for spreads.

23. The Excel Application box in the chapter (available at **www.mhhe.com/bkm;** link to Chapter 22 material) shows how to use the spot-futures parity relationship to find a "term structure of futures prices," that is, futures prices for various maturity dates.

eXcel
Please visit us at www.mhhe.com/bkm

a. Suppose that today is January 1, 2008. Assume the interest rate is 3% per year and a stock index currently at 1,100 pays a dividend yield of 1.5%. Find the futures price for contract maturity dates of February 14, 2008, May 21, 2008, and November 18, 2008.

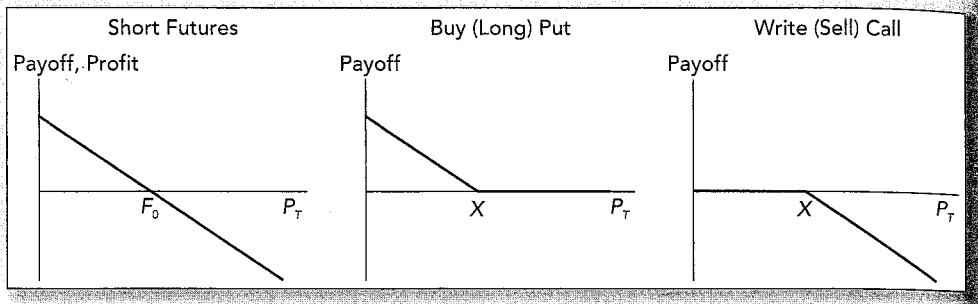
b. What happens to the term structure of futures prices if the dividend yield is higher than the risk-free rate? For example, what if the dividend yield is 4%?

24. What is the difference between the futures price and the value of the futures contract?

25. Evaluate the criticism that futures markets siphon off capital from more productive uses.

SOLUTIONS TO CONCEPT CHECKS

1.



2. The clearinghouse has a zero net position in all contracts. Its long and short positions are offsetting, so that net cash flow from marking to market must be zero.

3.

	Oil Price in May, P_T		
	$65.15	$67.15	$69.15
Cash flow to purchase oil: $-100{,}000 \times P_T$	−$6,515,000	−$6,715,000	−$6,915,000
+ Profit on long futures: $100{,}000 \times (P_T - F_0)$	−200,000	0	+200,000
TOTAL CASH FLOW	−$6,715,000	−$6,715,000	−$6,715,000

4. The risk would be that the index and the portfolio do not move perfectly together. Thus basis risk involving the spread between the futures price and the portfolio value could persist even if the index futures price were set perfectly relative to the index itself.

5.

Action	Initial Cash Flow	Cash Flow in 1 Year
Lend S_0 dollars	−1,300	1,300(1.04) = 1,352
Sell stock short	+1,300	$-S_T - 20$
Long futures	0	$S_T - 1{,}320$
TOTAL	0	$12 risklessly

6. It must have zero beta. If the futures price is an unbiased estimator, then we infer that it has a zero risk premium, which means that beta must be zero.

Solution to question in Words from the Street, "Presidential and Other Prediction Futures"
If you had purchased both Bush and Kerry futures (paying the ask price for each), you would have been guaranteed a payoff of $1 regardless of who won the election. If the cost of this "package" were less than $1, this would have been a riskless arbitrage opportunity which could not persist in well-functioning markets. Therefore, the sum of the ask prices must be more than $1. Similarly, if you had *sold* both Bush and Kerry futures (receiving the bid price for each), you would have had to make a payoff of $1 regardless of who won the election. If the revenue from selling this "package" were more than $1, this too would have been a riskless arbitrage opportunity which could not persist in well-functioning markets. Therefore, the sum of the bid prices must be less than $1. The spread between $1 and either the sum of the bid prices or the sum of the ask prices is the source of profit to the market maker.

E-Investments

Performance of Mutual Funds

Several popular finance-related Web sites offer mutual fund screeners. Go to **moneycentral.msn.com** and click on the *Investing* link on the top menu. Choose *Funds* from the submenu, then look for the *Easy Screener* link on the left-side menu. Before you start to specify your preferences using the drop-down boxes, look for the *Show More Options* link toward the bottom of the page and select it. When all of the options are shown, devise a screen for funds that meet the following criteria: 5-star Morningstar Overall Rating, a Minimum Initial Investment as low as possible, Low Morningstar Risk, No Load, Manager Tenure of at least 5 years, Morningstar Overall Return high, 12b-1 fees as low as possible, and Expense Ratio as low as possible. Click on the *Find Funds* link to run the screen.

When you get the list of results, you can sort them according to any one criterion that interests you by clicking on its column heading. Are there any funds you would rule out based on what you see? If you want to rerun the screen with different choices click on the *Change Criteria* link toward the top of the page and make the changes. Click on *Find Funds* again to run the new screen. You can click on any fund symbol to get more information about it.

Are any of these funds of interest to you? How might your screening choices differ if you were choosing funds for various clients?

STANDARD &POOR'S

Go to the *Market Insight* entry page (**www.mhhe.com/edumarketinsight**) and click on the *Commentary* tab. Follow the current Investment Policy Committee Notes (*USA IPC Notes*) link to open the notes. Answer the following questions based on information provided in the report:

- What recent and upcoming reports are listed in the *Economic Outlook* and the *Upcoming Reports* sections?
- What factors are important for the longer-term outlook?
- What fundamental and technical factors are discussed in the *Market Outlook* section?
- What is the current recommended allocation for each asset class?
- What are the year-end target levels for the S&P 500 index, the Federal Funds rate, real Gross Domestic Product growth, and West Texas Intermediate crude oil prices?
- Which sectors are recommended for overweighting in current portfolios? Which are recommended for underweighting?

How would you evaluate the usefulness of these asset allocation recommendations?

PROBLEMS

1. Consider the rate of return of stocks ABC and XYZ.

Year	r_{ABC}	r_{XYZ}
1	20%	30%
2	12	12
3	14	18
4	3	0
5	1	−10

a. Calculate the arithmetic average return on these stocks over the sample period.
b. Which stock has greater dispersion around the mean?
c. Calculate the geometric average returns of each stock. What do you conclude?

d. If you were equally likely to earn a return of 20%, 12%, 14%, 3%, or 1%, in each year (these are the five annual returns for stock ABC), what would be your expected rate of return? What if the five possible outcomes were those of stock XYZ?

2. XYZ stock price and dividend history are as follows:

Year	Beginning-of-Year Price	Dividend Paid at Year-End
1998	$100	$4
1999	120	4
2000	90	4
2001	100	4

An investor buys three shares of XYZ at the beginning of 1998, buys another two shares at the beginning of 1999, sells one share at the beginning of 2000, and sells all four remaining shares at the beginning of 2001.

a. What are the arithmetic and geometric average time-weighted rates of return for the investor?

b. What is the dollar-weighted rate of return? (Hint: Carefully prepare a chart of cash flows for the *four* dates corresponding to the turns of the year for January 1, 1998, to January 1, 2001. If your calculator cannot calculate internal rate of return, you will have to use trial and error.)

3. A manager buys three shares of stock today, and then sells one of those shares each year for the next 3 years. His actions and the price history of the stock are summarized below. The stock pays no dividends.

Time	Price	Action
0	$ 90	Buy 3 shares
1	100	Sell 1 share
2	100	Sell 1 share
3	100	Sell 1 share

a. Calculate the time-weighted geometric average return on this "portfolio."

b. Calculate the time-weighted arithmetic average return on this portfolio.

c. Calculate the dollar-weighted average return on this portfolio.

4. Based on current dividend yields and expected capital gains, the expected rates of return on portfolios *A* and *B* are 12% and 16%, respectively. The beta of *A* is .7, while that of *B* is 1.4. The T-bill rate is currently 5%, whereas the expected rate of return of the S&P 500 index is 13%. The standard deviation of portfolio *A* is 12% annually, that of *B* is 31%, and that of the S&P 500 index is 18%.

a. If you currently hold a market-index portfolio, would you choose to add either of these portfolios to your holdings? Explain.

b. If instead you could invest *only* in T-bills and *one* of these portfolios, which would you choose?

5. Consider the two (excess return) index-model regression results for stocks A and B. The risk-free rate over the period was 6%, and the market's average return was 14%. Performance is measured using an index model regression on excess returns.

	Stock A	Stock B
Index model regression estimates	$1\% + 1.2(r_M - r_f)$	$2\% + .8(r_M - r_f)$
R-square	.576	.436
Residual standard deviation, $\sigma(e)$	10.3%	19.1%
Standard deviation of excess returns	21.6%	24.9%

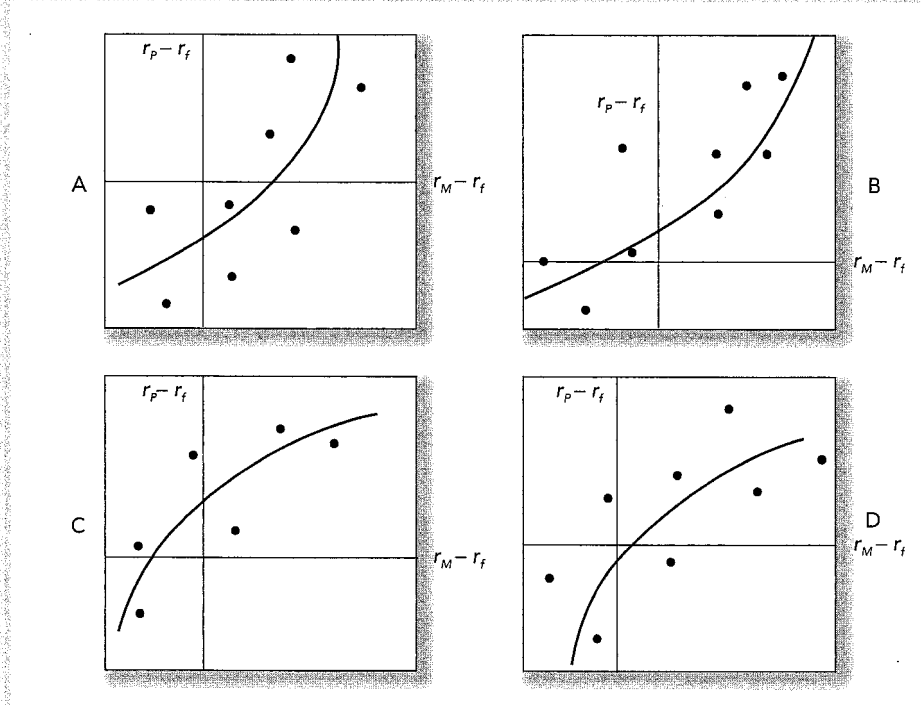
a. Calculate the following statistics for each stock:

i. Alpha
ii. Information ratio
iii. Sharpe measure
iv. Treynor measure

b. Which stock is the best choice under the following circumstances?

i. This is the only risky asset to be held by the investor.
ii. This stock will be mixed with the rest of the investor's portfolio, currently composed solely of holdings in the market index fund.
iii. This is one of many stocks that the investor is analyzing to form an actively managed stock portfolio.

6. Evaluate the market timing and security selection abilities of four managers whose performances are plotted in the accompanying diagrams.



7. Consider the following information regarding the performance of a money manager in a recent month. The table represents the actual return of each sector of the manager's portfolio in column 1, the fraction of the portfolio allocated to each sector in column 2, the benchmark or neutral sector allocations in column 3, and the returns of sector indices in column 4.

	Actual Return	Actual Weight	Benchmark Weight	Index Return
Equity	2%	.70	.60	2.5% (S&P 500)
Bonds	1	.20	.30	1.2 (Salomon Index)
Cash	0.5	.10	.10	0.5

a. What was the manager's return in the month? What was her overperformance or underperformance?

b. What was the contribution of security selection to relative performance?

c. What was the contribution of asset allocation to relative performance? Confirm that the sum of selection and allocation contributions equals her total "excess" return relative to the bogey.

8. A global equity manager is assigned to select stocks from a universe of large stocks throughout the world. The manager will be evaluated by comparing her returns to the return on the MSCI World Market Portfolio, but she is free to hold stocks from various countries in whatever proportions she finds desirable. Results for a given month are contained in the following table:

Country	Weight In MSCI Index	Manager's Weight	Manager's Return in Country	Return of Stock Index for That Country
U.K.	.15	.30	20%	12%
Japan	.30	.10	15	15
U.S.	.45	.40	10	14
Germany	.10	.20	5	12

a. Calculate the total value added of all the manager's decisions this period.
b. Calculate the value added (or subtracted) by her *country* allocation decisions.
c. Calculate the value added from her stock selection ability within countries. Confirm that the sum of the contributions to value added from her country allocation plus security selection decisions equals total over- or underperformance.

9. Conventional wisdom says that one should measure a manager's investment performance over an entire market cycle. What arguments support this convention? What arguments contradict it?

10. Does the use of universes of managers with similar investment styles to evaluate relative investment performance overcome the statistical problems associated with instability of beta or total variability?

11. During a particular year, the T-bill rate was 6%, the market return was 14%, and a portfolio manager with beta of .5 realized a return of 10%.

a. Evaluate the manager based on the portfolio alpha.
b. Reconsider your answer to part (*a*) in view of the Black-Jensen-Scholes finding that the security market line is too flat. Now how do you assess the manager's performance?

12. You and a prospective client are considering the measurement of investment performance, particularly with respect to international portfolios for the past 5 years. The data you discussed are presented in the following table:

CFA® PROBLEMS

International Manager or Index	Total Return	Country and Security Return	Currency Return
Manager A	–6.0%	2.0%	–8.0%
Manager B	–2.0	–1.0	–1.0
International Index	–5.0	0.2	–5.2

a. Assume that the data for Manager A and Manager B accurately reflect their investment skills and that both managers actively manage currency exposure. Briefly describe one strength and one weakness for each manager.
b. Recommend and justify a strategy that would enable your fund to take advantage of the strengths of each of the two managers while minimizing their weaknesses.

13. Carl Karl, a portfolio manager for the Alpine Trust Company, has been responsible since 2010 for the City of Alpine's Employee Retirement Plan, a municipal pension fund. Alpine is a growing community, and city services and employee payrolls have expanded in each of the past 10 years. Contributions to the plan in fiscal 2015 exceeded benefit payments by a three-to-one ratio.

CFA® PROBLEMS

The plan board of trustees directed Karl 5 years ago to invest for total return over the long term. However, as trustees of this highly visible public fund, they cautioned him that volatile or erratic results could cause them embarrassment. They also noted a state statute that mandated that not more than 25% of the plan's assets (at cost) be invested in common stocks.

At the annual meeting of the trustees in November 2015, Karl presented the following portfolio and performance report to the board:

Alpine Employee Retirement Plan

Asset Mix as of 9/30/15	At Cost (millions)		At Market (millions)	
Fixed-income assets:				
Short-term securities	$ 4.5	11.0%	$ 4.5	11.4%
Long-term bonds and mortgages	26.5	64.7	23.5	59.5
Common stocks	10.0	24.3	11.5	29.1
	$41.0	100.0%	$39.5	100.0%

Investment Performance

	Annual Rates of Return for Periods Ending 9/30/15	
	5 Years	1 Year
Total Alpine Fund:		
Time-weighted	8.2%	5.2%
Dollar-weighted (internal)	7.7%	4.8%
Assumed actuarial return	6.0%	6.0%
U.S. Treasury bills	7.5%	11.3%
Large sample of pension funds (average 60% equities, 40% fixed income)	10.1%	14.3%
Common stocks—Alpine Fund	13.3%	14.3%
Alpine portfolio beta coefficient	0.90	0.89
Standard & Poor's 500 stock index	13.8%	21.1%
Fixed-income securities—Alpine Fund	6.7%	1.0%
Salomon Brothers' bond index	4.0%	–11.4%

Karl was proud of his performance and was chagrined when a trustee made the following critical observations:

a. "Our 1-year results were terrible, and it's what you've done for us lately that counts most."
b. "Our total fund performance was clearly inferior compared to the large sample of other pension funds for the last 5 years. What else could this reflect except poor management judgment?"
c. "Our common stock performance was especially poor for the 5-year period."
d. "Why bother to compare your returns to the return from Treasury bills and the actuarial assumption rate? What your competition could have earned for us or how we would have fared if invested in a passive index (which doesn't charge a fee) are the only relevant measures of performance."
e. "Who cares about time-weighted return? If it can't pay pensions, what good is it!"

Appraise the merits of each of these statements and give counterarguments that Mr. Karl can use.

CFA® PROBLEMS

14. The Retired Fund is an open-ended mutual fund composed of $500 million in U.S. bonds and U.S. Treasury bills. This fund has had a portfolio duration (including T-bills) of between 3 and 9 years. Retired has shown first-quartile performance over the past 5 years, as measured by an independent fixed-income measurement service. However, the directors of the fund would like to

measure the market timing skill of the fund's sole bond investor manager. An external consulting firm has suggested the following three methods:

a. Method I examines the value of the bond portfolio at the beginning of every year, then calculates the return that would have been achieved had that same portfolio been held throughout the year. This return would then be compared with the return actually obtained by the fund.

b. Method II calculates the average weighting of the portfolio in bonds and T-bills for each year. Instead of using the actual bond portfolio, the return on a long-bond market index and T-bill index would be used. For example, if the portfolio on average was 65% in bonds and 35% in T-bills, the annual return on a portfolio invested 65% in a long-bond index and 35% in T-bills would be calculated. This return is compared with the annual return that would have been generated using the indexes and the manager's actual bond/T-bill weighting for each quarter of the year.

c. Method III examines the net bond purchase activity (market value of purchases less sales) for each quarter of the year. If net purchases were positive (negative) in any quarter, the performance of the bonds would be evaluated until the net purchase activity became negative (positive). Positive (negative) net purchases would be viewed as a bullish (bearish) view taken by the manager. The correctness of this view would be measured.

Critique *each* method with regard to market timing measurement problems.

Use the following data in solving Problems 15 and 16:

The administrator of a large pension fund wants to evaluate the performance of four portfolio managers. Each portfolio manager invests only in U.S. common stocks. Assume that during the most recent 5-year period, the average annual total rate of return including dividends on the S&P 500 was 14%, and the average nominal rate of return on government Treasury bills was 8%. The following table shows risk and return measures for each portfolio:

Portfolio	Average Annual Rate of Return	Standard Deviation	Beta
P	17%	20%	1.1
Q	24	18	2.1
R	11	10	0.5
S	16	14	1.5
S&P 500	14	12	1.0

CFA® PROBLEMS

15. What is the Treynor performance measure for portfolio *P*?

16. What is the Sharpe performance measure for portfolio *Q*?

CFA® PROBLEMS

17. An analyst wants to evaluate portfolio *X*, consisting entirely of U.S. common stocks, using both the Treynor and Sharpe measures of portfolio performance. The following table provides the average annual rate of return for portfolio *X*, the market portfolio (as measured by the S&P 500), and U.S. Treasury bills during the past 8 years:

CFA® PROBLEMS

	Average Annual Rate of Return	Standard Deviation of Return	Beta
Portfolio *X*	10%	18%	0.60
S&P 500	12	13	1.00
T-bills	6	N/A	N/A

a. Calculate the Treynor and Sharpe measures for both portfolio *X* and the S&P 500. Briefly explain whether portfolio *X* underperformed, equaled, or outperformed the S&P 500 on a risk-adjusted basis using both the Treynor measure and the Sharpe measure.

b. Based on the performance of portfolio *X* relative to the S&P 500 calculated in part (*a*), briefly explain the reason for the conflicting results when using the Treynor measure versus the Sharpe measure.

CFA® PROBLEMS

18. Assume you invested in an asset for 2 years. The first year you earned a 15% return, and the second year you earned a negative 10% return. What was your annual geometric return?

CFA® PROBLEMS

19. A portfolio of stocks generates a –9% return in 1999, a 23% return in 2000, and a 17% return in 2001. What is the annualized return (geometric mean) for the entire period?

CFA® PROBLEMS

20. A 2-year investment of $2,000 results in a cash flow of $150 at the end of the first year and another cash flow of $150 at the end of the second year, in addition to the return of the original investment. What is the internal rate of return on the investment?

CFA® PROBLEMS

21. In measuring the performance of a portfolio, the time-weighted rate of return is superior to the dollar-weighted rate of return because:

a. When the rate of return varies, the time-weighted return is higher.
b. The dollar-weighted return assumes all portfolio deposits are made on day 1.
c. The dollar-weighted return can only be estimated.
d. The time-weighted return is unaffected by the timing of portfolio contributions and withdrawals.

CFA® PROBLEMS

22. A pension fund portfolio begins with $500,000 and earns 15% the first year and 10% the second year. At the beginning of the second year, the sponsor contributes another $500,000. What were the time-weighted and dollar-weighted rates of return?

CFA® PROBLEMS

23. Pure market timers attempt to maintain a _____ portfolio beta and a _____ portfolio alpha.

a. Constant; shifting.
b. Shifting; zero.
c. Shifting; shifting.
d. Zero; zero.

CFA® PROBLEMS

24. The difference between an arithmetic average and a geometric average of returns

a. Increases as the variability of the returns increases.
b. Increases as the variability of the returns decreases.
c. Is always negative.
d. Depends on the specific returns being averaged, but is not necessarily sensitive to their variability.

CFA® PROBLEMS

25. During the annual review of Acme's pension plan, several trustees questioned their investment consultant about various aspects of performance measurement and risk assessment.

a. Comment on the appropriateness of using each of the following benchmarks for performance evaluation:

- Market index.
- Benchmark normal portfolio.
- Median of the manager universe.

b. Distinguish among the following performance measures:

- The Sharpe ratio.
- The Treynor measure.
- Jensen's alpha.

i. Describe how each of the three performance measures is calculated.
ii. State whether each measure assumes that the relevant risk is systematic, unsystematic, or total. Explain how each measure relates excess return and the relevant risk.

CFA® PROBLEMS

26. Trustees of the Pallor Corp. pension plan ask consultant Donald Millip to comment on the following statements. What should his response be?

i. Median manager benchmarks are statistically unbiased measures of performance over long periods of time.
ii. Median manager benchmarks are unambiguous and are therefore easily replicated by managers wishing to adopt a passive/indexed approach.
iii. Median manager benchmarks are not appropriate in all circumstances because the median manager universe encompasses many investment styles.