CHAPTER 10
BOND PRICES AND YIELDS

1.
   a. Catastrophe bond. Typically issued by an insurance company. They are similar to an insurance policy in that the investor receives coupons and par value, but takes a loss in part or all of the principal if a major insurance claims is filed against the issuer. This is provided in exchange for higher than normal coupons.
   b. Eurobonds are bonds issued in the currency of one country but sold in other national markets.
   c. Zero-coupon bonds are bonds that pay no coupons, but do pay a par value at maturity.
   d. Samurai bond. Yen-denominated bonds sold in Japan by non-Japanese issuers are called Samurai bonds.
   e. Junk bond. Those rated BBB or above (S&P, Fitch) or Baa and above (Moody's) are considered investment grade bonds, while lower-rated bonds are classified as speculative grade or junk bonds.
   f. Convertible bond. Convertible bonds may be exchanged, at the bondholder's discretion, for a specified number of shares of stock. Convertible bondholders "pay" for this option by accepting a lower coupon rate on the security.
   g. Serial bond. A serial bond is an issue in which the firm sells bonds with staggered maturity dates. As bonds mature sequentially, the principal repayment burden for the firm is spread over time just as it is with a sinking fund. Serial bonds do not include call provisions.
   h. Equipment obligation bond. A bond that is issued with specific equipment pledged as collateral against the bond.
   i. Original issue discount bonds are less common than coupon bonds issued at par. These are bonds that are issued intentionally with low coupon rates that cause the bond to sell at a discount from par value.
   j. Indexed bond. Indexed bonds make payments that are tied to a general price index or the price of a particular commodity.

2. Callable bonds give the issuer the option to extend or retire the bond at the call date, while the extendable or puttable bond gives this option to the bondholder.

3.
   a. YTM will drop since the company has more money to pay the interest on its bonds.
   b. YTM will increases since the company has more debt and the risk to the existing bond holders is now increased.
   c. YTM will decrease. Since the firm has either fewer current liabilities or an increase in various current assets.

4. Semi-annual coupon = 1,000 x .06 x .5 = $30. One month of accrued interest is 30 x (30/182) 4.945. at a price of 117 the invoice price is 1,170 + 4.945 = $1,174.95

5. Using a financial calculator, PV = -746.22, FV = 1,000, t=5, pmt = 0. The YTM is 6.0295%.
    Using a financial calculator, PV = -730.00, FV = 1,000, t=5, pmt = 0. The YTM is 6.4965%.

6. A bond's coupon interest payments and principal repayment are not affected by changes in market rates. Consequently, if market rates increase, bond investors in the secondary markets are not willing to pay as much for a claim on a given bond's fixed interest and principal payments as they would if market rates were lower. This relationship is apparent from the inverse relationship between interest rates and present value. An increase in the discount rate (i.e., the market rate) decreases the present value of the future cash flows.

7. The bond callable at 105 should sell at a lower price because the call provision is more valuable to the firm. Therefore, its yield to maturity should be higher.

8. The bond price will be lower. As time passes, the bond price, which is now above par value, will approach par.

9. Current yield = 48 / 970 = 4.95%

10. Using a financial calculator, FV = 1,000, t=7, pmt = 60, r=7. Price = 946.11
    The HPR = (946.11 – 1000 + 60) / 1000 = .0061 or 0.61% gain.

11. Zero coupon bonds provide no coupons to be reinvested. Therefore, the final value of the investor's proceeds from the bond is independent of the rate at which coupons could be reinvested (if they were paid). There is no reinvestment rate uncertainty with zeros.

12.

    a. Effective annual rate on three-month T-bill:

    $$\left(\frac{100,000}{97,645}\right)^4 - 1 = (1.02412)^4 - 1 = 0.1000 = 10.00\%$$

    b. Effective annual interest rate on coupon bond paying 5% semiannually:

    $$(1.05)^2 - 1 = 0.1025 = 10.25\%$$

    Therefore, the coupon bond has the higher effective annual interest rate.

13. The effective annual yield on the semiannual coupon bonds is 8.16%. If the annual coupon bonds are to sell at par they must offer the same yield, which requires an annual coupon of 8.16%.

14.

    a. The bond pays $50 every six months.

        Current price:

$$[\$50 \times \text{Annuity factor}(4\%, 6)] + [\$1000 \times \text{PV factor}(4\%, 6)] =$$

$$\$1,052.42$$

Assuming the market interest rate remains 4% per half year, price six months from now:

$$[\$50 \times \text{Annuity factor}(4\%, 5)] + [\$1000 \times \text{PV factor}(4\%, 5)] =$$

$$\$1,044.52$$

    b. Rate of return =

$$\frac{\$50 + (\$1,044.52 - \$1,052.42)}{\$1,052.42} = \frac{\$50 - \$7.90}{\$1,052.42} = 0.0400 = 4.00\% \text{ per six months}$$

15.

    a. Use the following inputs: n = 40, FV = 1000, PV = –950, PMT = 40. You will find that the yield to maturity on a semi-annual basis is 4.26%. This implies a bond equivalent yield to maturity of: 4.26% × 2 = 8.52%

Effective annual yield to maturity = $(1.0426)^2 - 1 = 0.0870 = 8.70\%$

    b. Since the bond is selling at par, the yield to maturity on a semi-annual basis is the same as the semi-annual coupon, 4%. The bond equivalent yield to maturity is 8%.

Effective annual yield to maturity = $(1.04)^2 - 1 = 0.0816 = 8.16\%$

    c. Keeping other inputs unchanged but setting PV = –1050, we find a bond equivalent yield to maturity of 7.52%, or 3.76% on a semi-annual basis.

Effective annual yield to maturity = $(1.0376)^2 - 1 = 0.0766 = 7.66\%$

16. Since the bond payments are now made annually instead of semi-annually, the bond equivalent yield to maturity is the same as the effective annual yield to maturity. The inputs are: n = 20, FV = 1000, PV = –price, PMT = 80. The resulting yields for the three bonds are:

Bond Price	Bond equivalent yield = Effective annual yield
$950	8.53%
$1,000	8.00%
$1,050	7.51%

The yields computed in this case are lower than the yields calculated with semi-annual coupon payments. All else equal, bonds with annual payments are less attractive to investors because more time elapses before payments are received. If the bond price is the same with annual payments, then the bond's yield to maturity is lower.

17.

Time	Inflation in year just ended	Par value	Coupon payment	Principal repayment
0		$1,000.00		
1	2%	$1,020.00	$40.80	0
2	3%	$1,050.60	$42.02	0
3	1%	$1,061.11	$42.44	$1,061.11

$$\text{Nominal return} = \frac{\text{Interest} + \text{Price appreciation}}{\text{Initial price}}$$

$$\text{Real return} = \frac{1 + \text{Nominal return}}{1 + \text{Inflation}} - 1$$

	Second year	Third year
Nominal return:	$\dfrac{\$42.02 + \$30.60}{\$1020} = 0.071196$	$\dfrac{\$42.44 + \$10.51}{\$1050.60} = 0.050400$
Real return:	$\dfrac{1.071196}{1.03} - 1 = 0.0400 = 4.00\%$	$\dfrac{1.05040}{1.01} - 1 = 0.0400 = 4.00\%$

The real rate of return in each year is precisely the 4% real yield on the bond.

18. Remember that the convention is to use semi-annual periods:

Price	Maturity (years)	Maturity (half-years)	Semi-annual YTM	Bond equivalent YTM
$400.00	20	40	2.32%	4.63%
$500.00	20	40	1.75%	3.50%
$500.00	10	20	3.53%	7.05%
$376.89	10	20	5.00%	10.00%
$456.39	10	20	4.00%	8.00%
$400.00	11.68	23.36	4.00%	8.00%

19. Using a financial calculator, PV = -800, FV = 1,000, t=10, pmt =80. The YTM is 11.46%.
    Using a financial calculator, FV = 1,000, t=9, pmt =80, r=11.46%. The new price will be 811.70. Thus, the capital gain is $11.70.

20. The reported bond price is: 100 2/32 percent of par = $1,000.625

    However, 15 days have passed since the last semiannual coupon was paid, so accrued interest equals: $35 x (15/182) = $2.885

    The invoice price is the reported price plus accrued interest: $1003.51

21. If the yield to maturity is greater than current yield, then the bond offers the prospect of price appreciation as it approaches its maturity date. Therefore, the bond is selling below par value.

22. The coupon rate is below 9%. If coupon divided by price equals 9%, and price is less than par, then coupon divided by par is less than 9%.

23. The solution is obtained using Excel:

	A	B	C	D	E
1		**5.50% coupon bond,**			
2		**maturing March 15, 2018**			
3			Formula in Column B		
4	Settlement	2/22/2010	DATE(2006,2,22)		
5	Maturity da	3/15/2018	DATE(2014,3,15)		
6	Annual cou	0.055			
7	Yield to ma	0.0534			
8	Redemptio	100			
9	Coupon pa	2			
10					
11					
12	Flat price (	101.03327	PRICE(B4,B5,B6,B7,B8,B9)		
13	Days since	160	COUPDAYBS(B4,B5,2,1)		
14	Days in co	181	COUPDAYS(B4,B5,2,1)		
15	Accrued in	2.43094	(B13/B14)*B6*100/2		
16	Invoice pric	103.46393	B12+B15		

24. The solution is obtained using Excel:

	A	B	C	D	E	F	G
1					Semiannual		Annual
2					coupons		coupons
3							
4	Settlement date				2/22/2010		2/22/2010
5	Maturity date				3/15/2018		3/15/2018
6	Annual coupon rate				0.055		0.055
7	Bond price				102		102
8	Redemption value (% of face value)				100		100
9	Coupon payments per year				2		1
10							
11	Yield to maturity (decimal)				0.051927		0.051889
12							
13							
14	Formula in cell E11:			YIELD(E4,E5,E6,E7,E8,E9)			

25. The stated yield to maturity equals 16.075%:

$[n = 10; \ PV = 900; \ FV = 1000; \ PMT = 140]$

Based on *expected* coupon payments of $70 annually,
the expected yield to maturity is: 8.526%

26. The bond is selling at par value. Its yield to maturity equals the coupon rate, 10%. If the first-year coupon is reinvested at an interest rate of r percent, then total proceeds at the end of the second year will be: $[100 \times (1 + r) + 1100]$. Therefore, realized compound yield to maturity will be a function of r as given in the following table:

r	Total proceeds	Realized YTM $= \sqrt{\text{Proceeds}/1000} - 1$
8%	$1208	$\sqrt{1208/1000} - 1 = 0.0991 = 9.91\%$
10%	$1210	$\sqrt{1210/1000} - 1 = 0.1000 = 10.00\%$
12%	$1212	$\sqrt{1212/1000} - 1 = 0.1009 = 10.09\%$

27. April 15 is midway through the semi-annual coupon period. Therefore, the invoice price will be higher than the stated ask price by an amount equal to one-half of the semiannual coupon. The ask price is 101.125 percent of par, so the invoice price is:

$$\$1{,}011.25 + (1/2 \times \$50) = \$1{,}036.25$$

28. Factors that might make the ABC debt more attractive to investors, therefore justifying a lower coupon rate and yield to maturity, are:

- The ABC debt is a larger issue and therefore may sell with greater liquidity.

- An option to extend the term from 10 years to 20 years is favorable if interest rates ten years from now are lower than today's interest rates. In contrast, if interest rates are rising, the investor can present the bond for payment and reinvest the money for better returns.

- In the event of trouble, the ABC debt is a more senior claim. It has more underlying security in the form of a first claim against real property.

- The call feature on the XYZ bonds makes the ABC bonds relatively more attractive since ABC bonds cannot be called from the investor.

- The XYZ bond has a sinking fund requiring XYZ to retire part of the issue each year. Since most sinking funds give the firm the option to retire this amount at the lower of par or market value, the sinking fund can work to the detriment of bondholders.

29.
   a. The floating-rate note pays a coupon that adjusts to market levels. Therefore, it will not experience dramatic price changes as market yields fluctuate. The fixed rate note therefore will have a greater price range.

   b. Floating rate notes may not sell at par for any of the several reasons: The yield spread between one-year Treasury bills and other money market instruments of comparable maturity could be wider than it was when the bond was issued.

      The credit standing of the firm may have eroded relative to Treasury securities that have no credit risk. Therefore, the 2% premium would become insufficient to sustain the issue at par.

The coupon increases are implemented with a lag, i.e., once every year. During a period of rising interest rates, even this brief lag will be reflected in the price of the security.

c. The risk of call is low. Because the bond will almost surely not sell for much above par value (given its adjustable coupon rate), it is unlikely that the bond will ever be called.

d. The fixed-rate note currently sells at only 93% of the call price, so that yield to maturity is above the coupon rate. Call risk is currently low, since yields would have to fall substantially for the firm to use its option to call the bond.

e. The 9% coupon notes currently have a remaining maturity of fifteen years and sell at a yield to maturity of 9.9%. This is the coupon rate that would be needed for a newly issued fifteen-year maturity bond to sell at par.

f. Because the floating rate note pays a *variable stream* of interest payments to maturity, its yield-to-maturity is not a well-defined concept. The cash flows one might want to use to calculate yield to maturity are not yet known. The effective maturity for comparing interest rate risk of floating rate debt securities with other debt securities is better thought of as the next coupon reset date rather than the final maturity date. Therefore, "yield-to-recoupon date" is a more meaningful measure of return.

30.

a. The bond sells for $1,124.72 based on the 3.5% yield to *maturity*:

   [n = 60; i = 3.5; FV = 1000; PMT = 40]

   Therefore, yield to *call* is 3.368% semiannually, 6.736% annually:

   [n = 10; PV = 1124.72; FV = 1100; PMT = 40]

b. If the call price were $1050, we would set FV = 1050 and redo part (a) to find that yield to call is 2.976% semi-annually, 5.952% annually. With a lower call price, the yield to call is lower.

c. Yield to call is 3.031% semiannually, 6.062% annually:

   [n = 4; PV = 1124.72 ; FV = 1100; PMT = 40]

31. The price schedule is as follows:

Year	Remaining Maturity (T)	Constant yield value $1000/(1.08)^T$	Imputed interest (Increase in constant yield value)
0 (now)	20 years	$214.55	
1	19	231.71	$17.16
2	18	250.25	18.54
19	1	925.93	
20	0	1000	74.07

32. The bond is issued at a price of $800. Therefore, its yield to maturity is 6.8245%. Using the constant yield method, we can compute that its price in one year (when maturity falls to 9 years) will be (at an unchanged yield) $814.60, representing an increase of $14.60. Total taxable income is: $40 + $14.60 = $54.60

33.
   a. The yield to maturity of the par bond equals its coupon rate, 8.75%. All else equal, the 4% coupon bond would be more attractive because its coupon rate is far below current market yields, and its price is far below the call price. Therefore, if yields fall, capital gains on the bond will not be limited by the call price. In contrast, the 8.75% coupon bond can increase in value to at most $1050, offering a maximum possible gain of only 5%. The disadvantage of the 8.75% coupon bond in terms of vulnerability to a call shows up in its higher *promised* yield to maturity.

   b. If an investor expects rates to fall substantially, the 4% bond offers a greater expected return.

   c. Implicit call protection is offered in the sense that any likely fall in yields would not be nearly enough to make the firm consider calling the bond. In this sense, the call feature is almost irrelevant.

34. True. Under the expectations hypothesis, there are no risk premia built into bond prices. The only reason for long-term yields to exceed short-term yields is an expectation of higher short-term rates in the future.

35. If the yield curve is upward sloping, you cannot conclude that investors expect short-term interest rates to rise because the rising slope could be due to either expectations of future increases in rates or the demand of investors for a risk premium on long-term bonds. In fact the yield curve can be upward sloping even in the absence of expectations of future increases in rates.

36.

	Zero	8% coupon	10% coupon
Current prices	$463.19	$1,000	$1,134.20
Price one year from now	$500.25	$1,000	$1,124.94
Price increase	$37.06	$0.00	($9.26)
Coupon income	$0.00	$80.00	$100.00
Income	$37.06	$80.00	$90.74
Rate of Return	8.00%	8.00%	8.00%

37. Uncertain. Lower inflation usually leads to lower nominal interest rates. Nevertheless, if the liquidity premium is sufficiently great, long-term yields can exceed short-term yields despite expectations of falling short rates.

38.

a. We obtain forward rates from the following table:

Maturity (years)	YTM	Forward rate	Price (for part c)
1	10.0%		$909.09 ($1000/1.10)
2	11.0%	12.01% [(1.11²/1.10) − 1]	$811.62 ($1000/1.11²)
3	12.0%	14.03% [(1.12³/1.11²) − 1]	$711.78 ($1000/1.12³)

b. We obtain next year's prices and yields by discounting each zero's face value at the forward rates derived in part (a):

Maturity (years)	Price		YTM
1	$892.78	[= 1000/1.1201]	12.01%
2	$782.93	[= 1000/(1.1201 x 1.1403)]	13.02%

Note that this year's upward sloping yield curve implies, according to the expectations hypothesis, a shift upward in next year's curve.

c. Next year, the two-year zero will be a one-year zero, and it will therefore sell at: $1000/1.1201 = $892.78

Similarly, the current three-year zero will be a two-year zero, and it will sell for: $782.93

Expected total rate of return:

two-year bond: $\dfrac{\$892.78}{\$811.62} - 1 = 0.1000 = 10.00\%$

three-year bond: $\dfrac{\$782.93}{\$711.78} - 1 = 0.1000 = 10.00\%$

39.

    a. The forward rate (f_2) is the rate that makes the return from rolling over one-year bonds the same as the return from investing in the two-year maturity bond and holding to maturity:

$$1.08 \times (1 + f_2) = (1.09)^2 \Rightarrow f_2 = 0.1001 = 10.01\%$$

    b. According to the expectations hypothesis, the forward rate equals the expected value of the short-term interest rate next year, so the best guess would be 10.01%.

    c. According to the liquidity preference hypothesis, the forward rate exceeds the expected short-term interest rate next year, so the best guess would be less than 10.01%.

40. The top row must be the spot rates. The spot rates are (geometric) averages of the forward rates, and the top row is the average of the bottom row. For example, the spot rate on a two-year investment (12%) is the average of the two forward rates 10% and 14.0364%:

$$(1.12)^2 = 1.10 \times 1.140364 = 1.2544$$

41. Using a financial calculator, PV = 100, t=3, pmt=0, r=6.5. Price or FV = 120.795. Using a financial calculator, PV = 100, t=4, pmt=0, r=7.0. Price or FV = 131.080. Setting PV = -120.795, FV = 131.080, t=1, pmt=0, solving for r produces the answer of 8.51%.

42.

    a. Initial price, $P_0 = 705.46$ [n = 20; PMT = 50; FV = 1000; i = 8]

Next year's price, $P_1 = 793.29$ [n = 19; PMT = 50; FV = 1000; i = 7]

$$HPR = \frac{\$50 + (\$793.29 - \$705.46)}{\$705.46} = 0.1954 = 19.54\%$$

    b. Using OID tax rules, the cost basis and imputed interest under the constant yield method are obtained by discounting bond payments at the *original* 8% yield to maturity, and simply reducing maturity by one year at a time:

Constant yield prices: compare these to actual prices to compute capital gains
$P_0 = \$705.46$
$P_1 = \$711.89$ so implicit interest over first year = $6.43
$P_2 = \$718.84$ so implicit interest over second year = $6.95

Tax on explicit plus implicit interest in first year

$$= 0.40 \times (\$50 + \$6.43) = \$22.57$$

Capital gain in first year = Actual price at 7% YTM − constant yield price

$= \$793.29 - \$711.89 = \$81.40$

Tax on capital gain $= 0.30 \times \$81.40 = \$24.42$

Total taxes $= \$22.57 + \$24.42 = \$46.99$

c. After tax HPR $= \dfrac{\$50 + (\$793.29 - \$705.46) - \$46.99}{\$705.46} = 0.1288 = 12.88\%$

d. Value of bond after two years equals $798.82 [using n = 18; i = 7]

Total income from the two coupons, including reinvestment income:

$(\$50 \times 1.03) + \$50 = \$101.50$

Total funds after two years: $798.82 + $101.50 = $900.32

Therefore, the $705.46 investment grows to $900.32 after two years.

$705.46 \,(1 + r)^2 = 900.32 \Rightarrow r = 0.1297 = 12.97\%$

e.

Coupon received in first year:	$50.00
Tax on coupon @ 40%	− 20.00
Tax on imputed interest (0.40 × $6.43)	− 2.57
Net cash flow in first year	$27.43

If you invest the year-1 cash flow at an after-tax rate of:

$3\% \times (1 - 0.40) = 1.8\%$

then, by year 2, it will grow to:

$\$27.43 \times 1.018 = \$27.92$

You sell the bond in the second year for:	$798.82	
Tax on *imputed* interest in second year:	− 2.78	[0.40 × $6.95]
Coupon received in second year, net of tax:	+ 30.00	[$50 × (1 − 0.40)]
Capital gains tax on sales price:	− 23.99	[0.30 × ($798.82 − $718.84)]
using constant yield value		
CF from first year's coupon (reinvested):	+ 27.92	[from above]
TOTAL	$829.97	

Thus, after two years, the initial investment of $705.46 grows to $829.97:

$705.46 \times (1 + r)^2 = 829.97 \Rightarrow r = 0.0847 = 8.47\%$

CFA 1

    a. (3) The yield on the callable bond must compensate the investor for the risk of call.

       Choice (1) is wrong because, although the owner of a callable bond receives principal plus a premium in the event of a call, the interest rate at which he can subsequently reinvest will be low. The low interest rate that makes it profitable for the issuer to call the bond makes it a bad deal for the bond's holder.

       Choice (2) is wrong because a bond is more apt to be called when interest rates are low. There will be an interest saving for the issuer only if rates are low.

    b. (3)

    c. (2)

    d. (3)

CFA 2

    a. The maturity of each bond is 10 years, and we assume that coupons are paid semiannually. Since both bonds are selling at par value, the current yield to maturity for each bond is equal to its coupon rate.

       If the yield declines by 1%, to 5% (2.5% semiannual yield), the Sentinal bond will increase in value to 107.79 [n=20; i = 2.5%; FV = 100; PMT = 3]
The price of the Colina bond will increase, but only to the call price of 102. The present value of scheduled payments is greater than 102, but the call price puts a ceiling on the actual bond price.

    b. If rates are expected to fall, the Sentinal bond is more attractive: since it is not subject to being called, its potential capital gains are higher.

       If rates are expected to rise, Colina is a better investment. Its higher coupon (which presumably is compensation to investors for the call feature of the bond) will provide a higher rate of return than the Sentinal bond.

    c. An increase in the volatility of rates increases the value of the firm's option to call back the Colina bond. [If rates go down, the firm can call the bond, which puts a cap on possible capital gains. So, higher volatility makes the option to call back the bond more valuable to the issuer.] This makes the Colina bond less attractive to the investor.

CFA 3

    Market conversion value = value if converted into stock = $20.83 \times \$28 = \$583.24$

    Conversion premium = Bond value − market conversion value

              = $\$775 - \$583.24 = \$191.76$

CFA 4

a. The call provision requires the firm to offer a higher coupon (or higher promised yield to maturity) on the bond in order to compensate the investor for the firm's option to call back the bond at a specified call price if interest rates fall sufficiently. Investors are willing to grant this valuable option to the issuer, but only for a price that reflects the possibility that the bond will be called. That price is the higher promised yield at which they are willing to buy the bond.

b. The call option reduces the expected life of the bond. If interest rates fall substantially so that the likelihood of call increases, investors will treat the bond as if it will "mature" and be paid off at the call date, not at the stated maturity date. On the other hand if rates rise, the bond must be paid off at the maturity date, not later. This asymmetry means that the expected life of the bond will be less than the stated maturity.

c. The advantage of a callable bond is the higher coupon (and higher promised yield to maturity) when the bond is issued. If the bond is never called, then an investor will earn a higher realized compound yield on a callable bond issued at par than on a non-callable bond issued at par on the same date. The disadvantage of the callable bond is the risk of call. If rates fall and the bond is called, then the investor receives the call price and will have to reinvest the proceeds at interest rates that are lower than the yield to maturity at which the bond was originally issued. In this event, the firm's savings in interest payments is the investor's loss.

CFA 5

a.

    (1)   Current yield = Coupon/Price = 70/960 = 0.0729 = 7.29%

    (2)   YTM = 3.993% semiannually or 7.986% annual bond equivalent yield

    [n = 10; PV = (-)960; FV = 1000; PMT = 35]

    Then compute the interest rate.

(3)   Realized compound yield is 4.166% (semiannually), or 8.332% annual bond equivalent yield. To obtain this value, first calculate the future value of reinvested coupons. There will be six payments of $35 each, reinvested semiannually at a per period rate of 3%:

[PV = 0; PMT = $35; n = 6; i = 3%] Compute FV = $226.39

The bond will be selling at par value of $1,000 in three years, since coupon is forecast to equal yield to maturity. Therefore, total proceeds in three years will be $1,226.39. To find realized compound yield on a semiannual basis (i.e., for six half-year periods), we solve:

$$\$960 \times (1 + y_{realized})^6 = \$1,226.39 \Rightarrow y_{realized} = 4.166\% \text{ (semiannual)}$$

b. Shortcomings of each measure:

(1)   Current yield does not account for capital gains or losses on bonds bought at prices other than par value. It also does not account for reinvestment income on coupon payments.

(2)   Yield to maturity assumes that the bond is held to maturity and that all coupon income can be reinvested at a rate equal to the yield to maturity.

(3)   Realized compound yield (horizon yield) is affected by the forecast of reinvestment rates, holding period, and yield of the bond at the end of the investor's holding period.

1. Duration can be thought of as a weighted average of the 'maturities' of the cash flows paid to holders of the perpetuity, where the weight for each cash flow is equal to the present value of that cash flow divided by the total present value of all cash flows. For cash flows in the distant future, present value approaches zero (i.e., the weight becomes very small) so that these distant cash flows have little impact, and eventually, virtually no impact on the weighted average.

2. A low coupon, long maturity bond will have the highest duration and will, therefore, produce the largest price change when interest rates change.

3. A rate anticipation swap should work. The trade would be to long the corporate bonds and short the treasuries. A relative gain will be realized when rate spreads return to normal.

4. $-25 = -(D/1.06) \times .0025 \times 1050$…solving for $D = 10.09$

5. d.

6. The increase will be larger than the decrease in price.

7. While it is true that short-term rates are more volatile than long-term rates, the longer duration of the longer-term bonds makes their rates of return more volatile. The higher duration magnifies the sensitivity to interest-rate savings. Thus, it can be true that *rates* of short-term bonds are more volatile, but the *prices* of long-term bonds are more volatile.

8. Computation of duration:
   a. YTM = 6%

(1) Time until Payment (Years)	(2) Payment	(3) Payment Discounted at 6%	(4) Weight	(5) Column (1) × Column (4)
1	60	56.60	0.0566	0.0566
2	60	53.40	0.0534	0.1068
3	1060	890.00	0.8900	2.6700
Column Sum:		1000.00	1.0000	2.8334

   Duration = 2.833 years

b. YTM = 10%

(1) Time until Payment (Years)	(2) Payment	(3) Payment Discounted at 10%	(4) Weight	(5) Column (1) × Column (4)
1	60	54.55	0.0606	0.0606
2	60	49.59	0.0551	0.1101
3	1060	796.39	0.8844	2.6531
	Column Sum:	900.53	1.0000	2.8238

Duration = 2.824 years, which is less than the duration at the YTM of 6%

9. The percentage bond price change is:

$$- \text{Duration} \times \frac{\Delta y}{1+y} = -7.194 \times \frac{0.0050}{1.10} = -0.0327 \text{ or a 3.27\% decline}$$

10. Computation of duration, interest rate = 10%:

(1) Time until Payment (Years)	(2) Payment (in millions of dollars)	(3) Payment Discounted At 10%	(4) Weight	(5) Column (1) × Column (4)
1	1	0.9091	0.2744	0.2744
2	2	1.6529	0.4989	0.9977
3	1	0.7513	0.2267	0.6803
	Column Sum:	3.3133	1.0000	1.9524

Duration = 1.9524 years

11. The duration of the perpetuity is: $(1 + y)/y = 1.10/0.10 = 11$ years
Let w be the weight of the zero-coupon bond. Then we find w by solving:

$$(w \times 1) + [(1 - w) \times 11] = 1.9523 \Rightarrow w = 9.048/10 = 0.9048$$

Therefore, your portfolio should be 90.48% invested in the zero and 9.52% in the perpetuity.

12. The percentage bond price change will be:

$$- \text{Duration} \times \frac{\Delta y}{1+y} = -5.0 \times \frac{-0.0010}{1.08} = 0.00463 \text{ or a 0.463\% increase}$$

13.

    a. Bond B has a higher yield to maturity than bond A since its coupon payments and maturity are equal to those of A, while its price is lower. (Perhaps the yield is higher because of differences in credit risk.) Therefore, the duration of Bond B must be shorter.

    b. Bond A has a lower yield and a lower coupon, both of which cause it to have a longer duration than that of Bond B. Moreover, Bond A cannot be called. Therefore, the maturity of Bond A is at least as long as that of Bond B, which implies that the duration of Bond A is at least as long as that of Bond B.

14. Choose the longer-duration bond to benefit from a rate decrease.

    a. The Aaa-rated bond has the lower yield to maturity and therefore the longer duration.

    b. The lower-coupon bond has the longer duration *and* more de facto call protection.

    c. The lower coupon bond has the longer duration.

15.

    a. The present value of the obligation is $17,832.65 and the duration is 1.4808 years, as shown in the following table:

Computation of duration, interest rate = 8%

(1) Time until Payment (Years)	(2) Payment	(3) Payment Discounted at 8%	(4) Weight	(5) Column (1) × Column (4)
1	10,000	9,259.26	0.5192	0.51923
2	10,000	8,573.39	0.4808	0.96154
Column Sum:		17,832.65	1.0000	1.48077

    b. To immunize the obligation, invest in a zero-coupon bond maturing in 1.4808 years. Since the present value of the zero-coupon bond must be $17,832.65, the face value (i.e., the future redemption value) must be:

$$\$17,832.65 \times (1.08)^{1.4808} = \$19,985.26$$

    c. If the interest rate increases to 9%, the zero-coupon bond would fall in value to:

$$\frac{\$19,985.26}{(1.09)^{1.4808}} = \$17,590.92$$

The present value of the tuition obligation would fall to $17,591.11, so that the net position changes by $0.19.

If the interest rate falls to 7%, the zero-coupon bond would rise in value to:

$$\frac{\$19,985.26}{(1.07)^{1.4808}} = \$18,079.99$$

The present value of the tuition obligation would increase to $18,080.18, so that the net position changes by $0.19.

The reason the net position changes at all is that, as the interest rate changes, so does the duration of the stream of tuition payments.

16.

a. PV of obligation = $2 million/0.16 = $12.5 million

Duration of obligation = 1.16/0.16 = 7.25 years

Call w the weight on the five-year maturity bond (with duration of 4 years). Then:

$(w \times 4) + [(1 - w) \times 11] = 7.25 \Rightarrow w = 0.5357$

Therefore:

$0.5357 \times \$12.5 = \$6.7$ million in the 5-year bond, and

$0.4643 \times \$12.5 = \$5.8$ million in the 20-year bond.

b. The price of the 20-year bond is:

$[60 \times$ Annuity factor(16%,20)$] + [1000 \times$ PV factor(16%, 20)$] = \$407.12$

Therefore, the bond sells for 0.4071 times its par value, so that:

Market value = Par value $\times 0.4071$

$5.8 million = Par value $\times 0.4071 \Rightarrow$ Par value = $14.25 million

Another way to see this is to note that each bond with par value $1000 sells for $407.11. If total market value is $5.8 million, then you need to buy:

$5,800,000/407.11 = 14,250$ bonds

Therefore, total par value is $14,250,000.

17.

a. The duration of the perpetuity is: 1.05/0.05 = 21 years

Let w be the weight of the zero-coupon bond, so that we find w by solving:

$(w \times 5) + [(1 - w) \times 21] = 10 \Rightarrow w = 11/16 = 0.6875$

Therefore, the portfolio will be 11/16 invested in the zero and 5/16 in the perpetuity.

b. The zero-coupon bond will then have a duration of 4 years while the perpetuity will still have a 21-year duration. To have a portfolio with duration equal to nine years, which is now the duration of the obligation, we again solve for w:

$(w \times 4) + [(1 - w) \times 21] = 9 \Rightarrow w = 12/17 = 0.7059$

So the proportion invested in the zero increases to 12/17 and the proportion in the perpetuity falls to 5/17.

18. Macaulay Duration and Modified Duration are calculated using Excel as follows:

Inputs		Formula in column B
Settlement date	5/27/2010	=DATE(2010,5,27)
Maturity date	11/15/2019	=DATE(2019,11,15)
Coupon rate	0.07	0.07
Yield to maturity	0.08	0.08
Coupons per year	2	2
Outputs		
Macaulay Duration	6.9659	=DURATION(B2,B3,B4,B5,B6)
Modified Duration	6.6980	=MDURATION(B2,B3,B4,B5,B6)

19. Macaulay Duration and Modified Duration are calculated using Excel as follows:

Inputs		Formula in column B
Settlement date	5/27/2010	=DATE(2010,5,27)
Maturity date	11/15/2019	=DATE(2019,11,15)
Coupon rate	0.07	0.07
Yield to maturity	0.08	0.08
Coupons per year	1	1
Outputs		
Macaulay Duration	6.8844	=DURATION(B2,B3,B4,B5,B6)
Modified Duration	6.3745	=MDURATION(B2,B3,B4,B5,B6)

Generally, we would expect duration to increase when the frequency of payment decreases from one payment per year to two payments per year, because more of the bond's payments are made further in to the future when payments are made annually. However, in this example, duration decreases as a result of the timing of the settlement date relative to the maturity date and the interest payment dates. For annual payments, the first payment is $70 paid on November 15, 2010. For semi-annual payments, the first $70 is paid as follows: $35 on November 15, 2010 and $35 on May 15, 2010, so the weighted average "maturity" these payments is shorter than the "maturity" of the $70 payment on November 15, 2010 for the annual payment bond.

20.
   a. The duration of the perpetuity is: 1.10/0.10 = 11 years
      The present value of the payments is: $1 million/0.10 = $10 million

      Let w be the weight of the five-year zero-coupon bond and therefore $(1 - w)$ is the weight of the twenty-year zero-coupon bond. Then we find w by solving:

      $$(w \times 5) + [(1 - w) \times 20] = 11 \Rightarrow w = 9/15 = 0.60$$

So, 60% of the portfolio will be invested in the five-year zero-coupon bond and 40% in the twenty-year zero-coupon bond.

Therefore, the market value of the five-year zero is:

$10 million × 0.60 = $6 million

Similarly, the market value of the twenty-year zero is:

$10 million × 0.40 = $4 million

b. Face value of the five-year zero-coupon bond is:

$6 million × $(1.10)^5$ = $9.66 million

Face value of the twenty-year zero-coupon bond is:

$4 million ×$(1.10)^{20}$ = $26.91 million

21. Convexity is calculated using the Excel spreadsheet below:

		Time (t)	Cash flow	PV(CF)	t + t^2	(t + t^2) x PV(CF)
Coupon	6	1	6	5.556	2	11.111
YTM	0.08	2	6	5.144	6	30.864
Maturity	7	3	6	4.763	12	57.156
Price	$89.59	4	6	4.41	20	88.204
		5	6	4.083	30	122.505
		6	6	3.781	42	158.803
		7	106	61.85	56	3463.599
		8	0	0	72	0
		9	0	0	90	0
		10	0	0	110	0
		Sum:		89.58726		3932.242
			Convexity:			37.631057

22.

a. Interest rate = 12%

	Time until Payment (Years)	Payment	Payment Discounted at 12%	Weight	Time × Weight
8% coupon	1	80	71.429	0.0790	0.0790
	2	80	63.776	0.0706	0.1411
	3	1080	768.723	0.8504	2.5513
		Sum:	903.927	1.0000	2.7714

Zero-coupon	1	0	0.000	0.0000	0.0000
	2	0	0.000	0.0000	0.0000
	3	1000	711.780	1.0000	3.0000
	Sum:		711.780	1.0000	3.0000

At a higher discount rate, the weights of the later payments of the coupon bond fall and those of the earlier payments rise. So duration falls. For the zero, the weight of the payment in three years remains at 1.0, and duration therefore remains at 3 years.

b. Continue to use a yield to maturity of 12%:

	Time until Payment (Years)	Payment	Payment Discounted at 12%	Weight	Time × Weight
8% coupon	1	120	107.143	0.1071	0.1071
	2	120	95.663	0.0957	0.1913
	3	1120	797.194	0.7972	2.3916
	Sum:		1000.000	1.0000	2.6901

The weights of the earlier payments are higher when the coupon increases. Therefore, duration falls.

23.

a.

Time until Payment (Years)	Payment	Payment Discounted at 10%	$t^2 + t$	$t^2 + t$ × PV
1	80	72.727	2	145.455
2	80	66.116	6	396.694
3	1080	811.420	12	9737.040
Sum:		950.263		10279.189

Convexity $= [10{,}279.189/(950.263 \times (1.10)^2] = 8.939838$

b. At a YTM of 10%, the zero-coupon bond with three-year maturity sells for 751.315 (see Spreadsheet 10.1). Its convexity is:

$$\frac{1}{P \times (1+y)^2} \times \frac{1{,}000}{(1+y)^t} \times (t^2 + t) = \frac{1}{751.315 \times 1.10^2} \times \frac{1{,}000}{1.10^3} \times (3^2 + 3) = 9.917353$$

24. Using a financial calculator, we find that the price of the bond is:
For yield to maturity of 7%: $1,620.45
For yield to maturity of 8%: $1,450.31
For yield to maturity of 9%: $1,308.21

Using the Duration Rule, assuming yield to maturity falls to 7%:

Predicted price change $= -$ Duration $\times \dfrac{\Delta y}{1+y} \times P_0$

$= -11.54 \times \dfrac{-0.01}{1.08} \times \$1{,}450.31 = \$154.97$

Therefore: Predicted price $= \$154.97 + \$1{,}450.31 = \$1{,}605.28$

The actual price at a 7% yield to maturity is \$1,620.45. Therefore:

% error $= \dfrac{\$1{,}620.45 - \$1{,}605.28}{\$1{,}620.45} = 0.0094 = 0.94\%$ (too low)

Using the Duration Rule, assuming yield to maturity increases to 9%:

Predicted price change $= -$ Duration $\times \dfrac{\Delta y}{1+y} \times P_0$

$= -11.54 \times \dfrac{+0.01}{1.08} \times \$1{,}450.31 = -\$154.97$

Therefore: Predicted price $= -\$154.97 + \$1{,}450.31 = \$1{,}295.34$

The actual price at a 9% yield to maturity is \$1,308.21. Therefore:

% error $= \dfrac{\$1{,}308.21 - \$1{,}295.34}{\$1{,}308.21} = 0.0098 = 0.98\%$ (too low)

Using Duration-with-Convexity Rule, assuming yield to maturity falls to 7%:

Predicted price change $= \left[\left(- \text{Duration} \times \dfrac{\Delta y}{1+y}\right) + \left(0.5 \times \text{Convexity} \times (\Delta y)^2\right)\right] \times P_0$

$= \left[\left(-11.54 \times \dfrac{-0.01}{1.08}\right) + \left(0.5 \times 192.4 \times (-0.01)^2\right)\right] \times \$1{,}450.31 = \$168.92$

Therefore: Predicted price $= \$168.92 + \$1{,}450.31 = \$1{,}619.23$

The actual price at a 7% yield to maturity is \$1,620.45. Therefore:

% error $= \dfrac{\$1{,}620.45 - \$1{,}619.23}{\$1{,}620.45} = 0.00075 = 0.075\%$ (too low)

Using Duration-with-Convexity Rule, assuming yield to maturity rises to 9%:

Predicted price change $= \left[\left(- \text{Duration} \times \dfrac{\Delta y}{1+y}\right) + \left(0.5 \times \text{Convexity} \times (\Delta y)^2\right)\right] \times P_0$

$= \left[\left(-11.54 \times \dfrac{+0.01}{1.08}\right) + \left(0.5 \times 192.4 \times (0.01)^2\right)\right] \times \$1{,}450.31 = -\$141.02$

Therefore: Predicted price $= -\$141.02 + \$1,450.31 = \$1,309.29$

The actual price at a 9% yield to maturity is $\$1,308.21$. Therefore:

$$\% \text{ error } = \frac{\$1,309.29 - \$1,308.21}{\$1,308.21} = 0.00083 = 0.083\% \text{ (too high)}$$

Conclusion: The duration-with-convexity rule provides more accurate approximations to the actual change in price. In this example, the percentage error using convexity with duration is less than one-tenth the error using duration only to estimate the price change.

24. You should buy the three-year bond because it will offer a 9% holding-period return over the next year, which is greater than the return on either of the other bonds, as shown below:

Maturity	One year	Two years	Three years
YTM at beginning of year	7.00%	8.00%	9.00%
Beginning of year price	$1,009.35	$1,000.00	$974.69
End of year price (at 9% YTM)	$1,000.00	$990.83	$982.41
Capital gain	−$ 9.35	−$ 9.17	$7.72
Coupon	$80.00	$80.00	$80.00
One year total $ return	$70.65	$70.83	$87.72
One year total rate of return	7.00%	7.08%	9.00%

25. The maturity of the 30-year bond will fall to 25 years, and the yield is forecast to be 8%. Therefore, the price forecast for the bond is:
    $893.25 [n = 25; i = 8; FV = 1000; PMT = 70]

At a 6% interest rate, the five coupon payments will accumulate to $394.60 after five years. Therefore, total proceeds will be:
    $394.60 + $893.25 = $1,287.85

The five-year return is therefore: ($1,287.85/867.42) – 1 = 1.48469 – 1 = 48.469%
The annual rate of return is: $(1.48469)^{(1/5)} - 1 = 0.0822 = 8.22\%$
The maturity of the 20-year bond will fall to 15 years, and its yield is forecast to be 7.5%. Therefore, the price forecast for the bond is:
    $911.73 [n = 15; i = 7.5; FV = 1000; PMT = 65]

At a 6% interest rate, the five coupon payments will accumulate to $366.41 after five years. Therefore, total proceeds will be:
    $366.41 + $911.73 = $1,278.14

The five-year return is therefore: ($1,278.14/$879.50) – 1 = 1.45326 – 1 = 45.326%
The annual rate of return is: $1.45326^{(1/5)} - 1 = 0.0776 = 7.76\%$
The 30-year bond offers the higher expected return.

26.

    a. Using a financial calculator, we find that the price of the zero-coupon bond (with $1000 face value) is:

For yield to maturity of 8%: $374.84
For yield to maturity of 9%: $333.28
The price of the 6% coupon bond is:
For yield to maturity of 8%: $774.84
For yield to maturity of 9%: $691.79

Zero coupon bond

$$\text{Actual \% loss} = \frac{\$333.28 - \$374.84}{\$374.84} = -0.1109 \text{, an 11.09\% loss}$$

The percentage loss predicted by the duration-with-convexity rule is:

$$\text{Predicted \% loss} = [(-11.81) \times 0.01] + [0.5 \times 150.3 \times (0.01)^2]$$
$$= -0.1106 \text{, an 11.06\% loss}$$

Coupon bond

$$\text{Actual \% loss} = \frac{\$691.79 - \$774.84}{\$774.84} = -0.1072 \text{, a 10.72\% loss}$$

The percentage loss predicted by the duration-with-convexity rule is:

$$\text{Predicted \% loss} = [(-11.79) \times 0.01] + [0.5 \times 231.2 \times (0.01)^2]$$
$$= -0.1063 \text{, a 10.63\% loss}$$

    b. Now assume yield to maturity falls to 7%. The price of the zero increases to $422.04, and the price of the coupon bond increases to $875.91.
Zero coupon bond

$$\text{Actual \% gain} = \frac{\$422.04 - \$374.84}{\$374.84} = 0.1259 \text{, a 12.59\% gain}$$

The percentage gain predicted by the duration-with-convexity rule is:

$$\text{Predicted \% gain} = [(-11.81) \times (-0.01)] + [0.5 \times 150.3 \times (-0.01)^2]$$
$$= 0.1256 \text{, a 12.56\% gain}$$

Coupon bond

$$\text{Actual \% gain} = \frac{\$875.91 - \$774.84}{\$774.84} = 0.1304 \text{, a 13.04\% gain}$$

The percentage gain predicted by the duration-with-convexity rule is:

$$\text{Predicted \% gain} = [(-11.79) \times (-0.01)] + [0.5 \times 231.2 \times (-0.01)^2]$$
$$= 0.1295 \text{, a 12.95\% gain}$$

c. The 6% coupon bond (which has higher convexity) outperforms the zero regardless of whether rates rise or fall. This is a general property which can be understood by first noting from the duration-with-convexity formula that the duration effect resulting from the change in rates is the same for the two bonds because their durations are approximately equal. However, the convexity effect, which is always positive, always favors the higher convexity bond. Thus, if the yields on the bonds always change by equal amounts, as we have assumed in this example, the higher convexity bond always outperforms a lower convexity bond with the same duration and initial yield to maturity.

d. This situation cannot persist. No one would be willing to buy the lower convexity bond if it always underperforms the other bond. The price of the lower convexity bond will fall and its yield to maturity will rise. Thus, the lower convexity bond will sell at a higher initial yield to maturity. That higher yield is compensation for the lower convexity. If rates change only slightly, the higher yield-lower convexity bond will perform better; if rates change by a greater amount, the lower yield-higher convexity bond will do better.

CFA 1

C:	Highest maturity, zero coupon
D:	Highest maturity, next-lowest coupon
A:	Highest maturity, same coupon as remaining bonds
B:	Lower yield to maturity than bond E
E:	Highest coupon, shortest maturity, highest yield of all bonds.

CFA 2

a. Modified duration $= \dfrac{\text{Macaulay duration}}{1 + \text{YTM}}$

If the Macaulay duration is 10 years and the yield to maturity is 8%, then the modified duration is: $10/1.08 = 9.26$ years

b. For option-free coupon bonds, modified duration is better than maturity as a measure of the bond's sensitivity to changes in interest rates. Maturity considers only the final cash flow, while modified duration includes other factors such as the size and timing of coupon payments and the level of interest rates (yield to maturity). Modified duration, unlike maturity, tells us the approximate proportional change in the bond price for a given change in yield to maturity.

c. Modified duration increases as the coupon decreases.

    ii. Modified duration decreases as maturity decreases.

CFA 3

a. *Scenario (i)*: Strong economic recovery with rising inflation expectations. Interest rates and bond yields will most likely rise, and the prices of both bonds will fall. The probability that the callable bond will be called declines, so that it will behave more like the non-callable bond. (Notice that they have similar durations when priced to maturity.) The slightly lower duration of the callable bond will result in somewhat better performance in the high interest rate scenario.

Scenario (ii): Economic recession with reduced inflation expectations. Interest rates and bond yields will most likely fall. The callable bond is likely to be called. The relevant duration calculation for the callable bond is now its modified duration to call. Price appreciation is limited as indicated by the lower duration. The non-callable bond, on the other hand, continues to have the same modified duration and hence has greater price appreciation.

b. If yield to maturity (YTM) on Bond B falls by 75 basis points:

Projected price change = (modified duration) × (change in YTM)

$$= (-6.80) \times (-0.75\%) = 5.1\%$$

So the price will rise to approximately $105.10 from its current level of $100.

c. For Bond A (the callable bond), bond life and therefore bond cash flows are uncertain. If one ignores the call feature and analyzes the bond on a "to maturity" basis, all calculations for yield and duration are distorted. Durations are too long and yields are too high. On the other hand, if one treats the premium bond selling above the call price on a "to call" basis, the duration is unrealistically short and yields too low.

The most effective approach is to use an option valuation approach. The callable bond can be decomposed into two separate securities: a non-callable bond and an option.

Price of callable bond = Price of non-callable bond – price of option

Since the option to call the bond always has a positive value, the price of the callable bond is always less than the price of the non-callable security.

CFA 4

a. The Aa bond initially has the higher yield to maturity (yield spread of 40 b.p. versus 31 b.p.), but the Aa bond is expected to have a widening spread relative to Treasuries. This will reduce rate of return. The Aaa spread is expected to be stable. Calculate comparative returns as follows:

Incremental return over Treasuries:
Incremental yield spread − (Change in spread × duration)
Aaa bond: 31 bp − (0 × 3.1) = 31 bp
Aa bond: 40 bp − (10 bp × 3.1) = 9 bp

So choose the Aaa bond.

 b. Other variables that one should consider:

- Potential changes in issue-specific credit quality. If the credit quality of the bonds changes, spreads relative to Treasuries will also change.
- Changes in relative yield spreads for a given bond rating. If quality spreads in the general bond market change because of changes in required risk premiums, the yield spreads of the bonds will change even if there is no change in the assessment of the credit quality of these *particular* bonds.
- Maturity effect. As bonds near maturity, the effect of credit quality on spreads can also change. This can affect bonds of different initial credit quality differently.

CFA 5

 $\Delta P/P = -D^* \, \Delta y$
  For Strategy I:
  5-year maturity: $\Delta P/P = -4.83 \times (-0.75\%) = 3.6225\%$
  25-year maturity: $\Delta P/P = -23.81 \times 0.50\% = -11.9050\%$
  Strategy I: $\Delta P/P = (0.5 \times 3.6225\%) + [0.5 \times (-11.9050\%)] = -4.1413\%$
  For Strategy II:
  15-year maturity: $\Delta P/P = -14.35 \times 0.25\% = -3.5875\%$

CFA 6

 a. For an option-free bond, the effective duration and modified duration are approximately the same. The duration of the bond described in Table 22A is calculated as follows:
   Duration $= (100.71 - 99.29)/(2 \times 100 \times 0.001) = 7.1$

 b. The total percentage price change for the bond described in Table 22A is estimated as follows:
   Percentage price change using duration $= -7.90 \times -0.02 \times 100 = 15.80\%$
   Convexity adjustment $= 1.66\%$
   Total estimated percentage price change $= 15.80\% + 1.66\% = 17.46\%$

CFA 7
 a. i. Duration $= (116.887 - 100.00)/(2 \times 100 \times 0.01) = 15.26$
  ii. Portfolio duration $= (50/98.667) \times 15.26 + (48.667/98.667) \times 2.15 = 8.79$

 b. The statement would only be correct if the portfolio consisted of only zero coupon bonds.

CFA 8

    a. The two risks are price risk and reinvestment rate risk. The former refers to bond price volatility as interest rates fluctuate, the latter to uncertainty in the rate at which coupon income can be reinvested.

    b. Immunization is the process of structuring a bond portfolio in such a manner that the value of the portfolio (including proceeds reinvested) will reach a given target level regardless of future changes in interest rates. This is accomplished by matching both the values and durations of the assets and liabilities of the plan. This may be viewed as a low-risk bond management strategy.

    c. Duration matching is superior to maturity matching because bonds of equal duration -- not those of equal maturity -- are equally sensitive to interest rate fluctuations.

    d. Contingent immunization allows for active bond management unless and until the surplus funding in the account is eliminated because of investment losses, at which point an immunization strategy is implemented. Contingent immunization allows for the possibility of above-market returns if the active management is successful.

CFA 9

    The economic climate is one of impending interest rate increases. Hence, we will want to shorten portfolio duration.
    a. Choose the short maturity (2014) bond.

    b. The Arizona bond likely has lower duration. Coupons are about equal, but the Arizona yield is higher.

    c. Choose the 9⅜ % coupon bond. Maturities are about equal, but the coupon is much higher, resulting in lower duration.

    d. The duration of the Shell bond will be lower if the effect of the higher yield to maturity and earlier start of sinking fund redemption dominates the slightly lower coupon rate.

    e. The floating rate bond has a duration that approximates the adjustment period, which is only six months.

CFA 10

    a. 4
    b. 4
    c. 4
    d. 2

CFA 11

    a. A manager who believes that the level of interest rates will change should engage in a rate anticipation swap, lengthening duration if rates are expected to fall, and shortening duration if rates are expected to rise.

    b. A change in yield spreads across sectors would call for an inter-market spread swap, in which the manager buys bonds in the sector for which yields are expected to fall and sells bonds in the sector for which yields are expected to rise.

    c. A belief that the yield spread on a particular instrument will change calls for a substitution swap in which that security is sold if its relative yield is expected to rise or is bought if its yield is expected to fall compared to other similar bonds.

CFA 12

    a. This swap would have been made if the investor anticipated a decline in long-term interest rates and an increase in long-term bond prices. The deeper discount, lower coupon $2\frac{3}{8}\%$ bond would provide more opportunity for capital gains, greater call protection, and greater protection against declining reinvestment rates at a cost of only a modest drop in yield.

    b. This swap was probably done by an investor who believed the 24 basis point yield spread between the two bonds was too narrow. The investor anticipated that, if the spread widened to a more normal level, either a capital gain would be experienced on the Treasury note or a capital loss would be avoided on the Phone bond, or both. This swap might also have been done by an investor who anticipated a decline in interest rates, and who also wanted to maintain high current coupon income and have the better call protection of the Treasury note. The Treasury note would have much greater potential for price appreciation, in contrast to the Phone bond which would be restricted by its call price. Furthermore, if intermediate-term interest rates were to rise, the price decline of the higher quality, higher coupon Treasury note would likely be "cushioned" and the reinvestment return from the higher coupons would likely be greater.

    c. This swap would have been made if the investor were bearish on the bond market. The zero coupon note would be extremely vulnerable to an increase in interest rates since the yield to maturity, determined by the discount at the time of purchase, is locked in. This is in contrast to the floating rate note, for which interest is adjusted periodically to reflect current returns on debt instruments. The funds received in interest income on the floating rate notes could be used at a later time to purchase long-term bonds at more attractive yields.

d. These two bonds are similar in most respects other than quality and yield. An investor who believed the yield spread between Government and Al bonds was too narrow would have made the swap either to take a capital gain on the Government bond or to avoid a capital loss on the Al bond. The increase in call protection after the swap would not be a factor except under the most bullish interest rate scenarios. The swap does, however, extend maturity another 8 years and yield to maturity sacrifice is 169 basis points.

e. The principal differences between these two bonds are the convertible feature of the Z mart bond, and, for the Lucky Duck debentures, the yield and coupon advantage, and the longer maturity. The swap would have been made if the investor believed some combination of the following:

First, that the appreciation potential of the Z mart convertible, based primarily on the intrinsic value of Z mart common stock, was no longer as attractive as it had been.

Second, that the yields on long-term bonds were at a cyclical high, causing bond portfolio managers who could take A2-risk bonds to reach for high yields and long maturities either to lock them in or take a capital gain when rates subsequently declined.

Third, while waiting for rates to decline, the investor will enjoy an increase in coupon income. Basically, the investor is swapping an equity-equivalent for a long-term corporate bond.

CHAPTER 12
MACROECONOMIC AND INDUSTRY ANALYSIS

1.

   A top-down approach to security valuation begins with an analysis of the global and domestic economy. Analysts who follow a top-down approach then narrow their attention to an industry or sector likely to perform well, given the expected performance of the broader economy. Finally, the analysis focuses on specific companies within an industry or sector that has been identified as likely to perform well. A bottom-up approach typically emphasizes fundamental analysis of individual company stocks, and is largely based on the belief that undervalued stocks will perform well regardless of the prospects for the industry or the broader economy. The major advantage of the top-down approach is that it provides a structured approach to incorporating the impact of economic and financial variables, at every level, in to analysis of a company's stock. One would expect, for example, that prospects for a particular industry are highly dependent on broader economic variables. Similarly, the performance of an individual company's stock is likely to be greatly affected by the prospects for the industry in which the company operates.

2. The yield curve, by definition, incorporates future interest rates. As such, it reflects future expectations and is a leading indicator.

3. Stalwarts. They tend to be in noncyclical industries that are relatively unaffected by recessions.

4. A supply shock

5. Financial leverage increases the sensitivity of profits in the business cycle since it is a fixed cost. Firms with high fixed costs are said to have high operating leverage, as small swings in business conditions can have large impacts on profitability.

6. Asset play

7. A peak is the transition from the end of an expansion to the start of a contraction. A trough occurs at the bottom of a recession just as the economy enters a recovery. Contraction is the period from peak to trough. Expansion is the period from trough to peak.

8. Companies tend to pay very low, if any, dividends early in their business life cycle since these firms need to reinvest as much capital as possible in order to grow.

9. $(1+n) = (1+r)x(1+i)\ldots$ $(1+.05) = (1+r)x(1+.03)\ldots$ solving for $r = .0194$

10. $DOL = 1 + (7/4) = 2.75$

11. This exercise is left to the student

12. Expansionary (i.e., looser) monetary policy to lower interest rates would help to stimulate investment and expenditures on consumer durables. Expansionary fiscal policy (i.e., lower taxes, higher government spending, increased welfare transfers) would directly stimulate aggregate demand.

13. A depreciating dollar makes imported cars more expensive and American cars cheaper to foreign consumers. This should benefit the U.S. auto industry.

14.
   a. Gold Mining. Gold is traditionally viewed as a hedge against inflation. Expansionary monetary policy may lead to increased inflation, and could thus enhance the value of gold mining stocks.

   b. Construction. Expansionary monetary policy will lead to lower interest rates which ought to stimulate housing demand. The construction industry should benefit.

15.
   a. The robotics process entails higher fixed costs and lower variable (labor) costs. Therefore, this firm will perform better in a boom and worse in a recession. For example, costs will rise less rapidly than revenue when sales volume expands during a boom.
   b. Because its profits are more sensitive to the business cycle, the robotics firm will have the higher beta.

16. Supply side economists believe that a reduction in income tax rates will make workers more willing to work at current or even slightly lower (gross-of-tax) wages. Such an effect ought to mitigate cost pressures on the inflation rate.

17.
   Deep recession   Health care (non-cyclical)
   Superheated economy   Steel production (cyclical)
   Healthy expansion   Housing construction (cyclical, but interest rate sensitive)
   Stagflation   Gold mining (counter cyclical)

18.
   a. General Autos. Pharmaceutical purchases are less discretionary than automobile purchases.

   b. Friendly Airlines. Travel expenditures are more sensitive to the business cycle than movie consumption.

19.

a. Oil well equipment   Decline (environmental pressures, decline
                         in easily-developed oil fields)
b. Computer hardware   Consolidation stage
c. Computer software   Consolidation stage
d. Genetic engineering Start-up stage
e. Railroads   Relative decline

20. The index of consumer expectations is a useful leading economic indicator because, if consumers are optimistic about the future, then they are more willing to spend money, especially on consumer durables. This spending will increase aggregate demand and stimulate the economy.

21. Labor cost per unit of output is a lagging indicator because wages typically start rising well into an economic expansion. At the beginning of an expansion, there is considerable slack in the economy and output can expand without employers bidding up the price of inputs or the wages of employees. By the time wages start increasing due to high demand for labor, the boom period has already progressed considerably.

22.

a. Because of the very short average maturity (30 days), the rate of return on the money market fund will be affected only slightly by changes in interest rates. The fund might be a good place to "park" cash if you forecast an increase in interest rates, especially given the high liquidity of money market funds. The $5,000 can be reinvested in longer-term assets after rates increase.

b. If you are relatively neutral on rates, the one-year CD might be a reasonable "middle-ground" choice. The CD provides a higher return than the money market fund, unless rates rise considerably. On the other hand, the CD has far less interest rate risk (that is, a much lower duration) than the 20-year bond, and therefore less exposure to interest rate increases.

c. The long-term bond is the best choice for an investor who wants to speculate on a decrease in rates.

23. The expiration of the patent means that General Weedkillers will soon face considerably greater competition from its competitors. We would expect prices and profit margins to fall, and total industry sales to increase somewhat as prices decline. The industry will probably enter the consolidation stage in which producers are forced to compete more extensively on the basis of price.

24.

	2	1
Sales (mil)		
Price per unit	200	200
Var Cost per unit	-140	-140
Revenue	400	200
Variable cost	-280	-140
Fixed cost	-30	-30
EBT	90	30
Taxes	-27	-9
Net Income	63	21

Percentage change in sales	100%
Percentage chagne in profits	200%
DOL =	2.00

CFA 1

a. Relevant data items from the table that support the conclusion that the retail auto parts industry as a whole is in the maturity phase of the industry life cycle are:
1. The population of 18 to 29-year olds, a major customer base for the industry, is gradually declining.
2. The number of households with income less than $40,000, another important consumer base, is not expanding.
3. The number of cars 5 to 15 years old, an important end market, has experienced low annual growth (and actual declines in some years), so that the number of units potentially in need of parts is not growing.
4. Automotive aftermarket industry retail sales have been growing slowly for several years.
5. Consumer expenditures on automotive parts and accessories have grown slowly for several years.
6. Average operating margins of all retail auto parts companies have steadily declined.

b. Relevant items of data from the table that support the conclusion that Wigwam Autoparts Heaven, Inc. (WAH) and its major competitors are in the consolidation stage of their life cycle are:
1. Sales growth of retail auto parts companies with 100 or more stores have been growing rapidly and at an increasing rate.
2. Market share of retail auto parts stores with 100 or more stores has been increasing, but is still less than 20 percent, leaving room for much more growth.

3. Average operating margins for retail auto parts companies with 100 or more stores are high and rising.

Because of industry fragmentation (i.e., most of the market share is distributed among many companies with only a few stores), the retail auto parts industry apparently is undergoing marketing innovation and consolidation. The industry is moving toward the "category killer" format, in which a few major companies control large market shares through proliferation of outlets. The evidence suggests that a new "industry within an industry" is emerging in the form of the "category killer" large chain-store company. This industry subgroup is in its consolidation stage (i.e., rapid growth with high operating profit margins and emerging market leaders) despite the fact that the industry is in the maturity stage of its life cycle.

CFA 2

a. The concept of an industrial life cycle refers to the tendency of most industries to go through various stages of growth. The rate of growth, the competitive environment, profit margins and pricing strategies tend to shift as an industry moves from one stage to the next, although it is difficult to pinpoint exactly when one stage has ended and the next begun.

The start-up stage is characterized by perceptions of a large potential market and by high optimism for potential profits. In this stage, however, there is usually a high failure rate. In the second stage, often called rapid growth or consolidation, growth is high and accelerating, markets broaden, unit costs decline and quality improves. In this stage, industry leaders begin to emerge. The third stage, usually called the maturity stage, is characterized by decelerating growth caused by such things as maturing markets and/or competitive inroads by other products. Finally, an industry reaches a stage of relative decline, in which sales slow or even decline.

Product pricing, profitability and industry competitive structure often vary by phase. Thus, for example, the first phase usually encompasses high product prices, high costs (R&D, marketing, etc.) and a (temporary) monopolistic industry structure. In phase two (consolidation stage), new entrants begin to appear and costs fall rapidly due to the learning curve. Prices generally do not fall as rapidly, however, allowing profit margins to increase. In phase three (maturity stage), growth begins to slow as the product or service begins to saturate the market, and margins are eroded by significant price reductions. In the final stage, cumulative industry production is so high that production costs have stopped declining, profit margins are thin (assuming competition exists), and the fate of the industry depends on the extent of replacement demand and the existence of substitute products/services.

b. The passenger car business in the United States has probably entered the final stage in the industrial life cycle because normalized growth is quite low. The information processing business, on the other hand, is undoubtedly earlier in the cycle. Depending on whether or not growth is still accelerating, it is either in the second or third stage.

c. Cars: In the final phases of the life cycle, demand tends to be price sensitive. Thus, Universal can not raise prices without losing volume. Moreover, given the industry's maturity, cost structures are likely to be similar for all competitors, and any price cuts can be matched immediately. Thus, Universal's car business is boxed in: Product pricing is determined by the market, and the company is a "price-taker."

Idata: Idata should have much more pricing flexibility given that it is in an earlier phase of the industrial life cycle. Demand is growing faster than supply, and, depending on the presence and/or actions of an industry leader, Idata may price high in order to maximize current profits and generate cash for product development, or price low in an effort to gain market share.

CFA 3

a. A basic premise of the business cycle approach to investing is that stock prices anticipate fluctuations in the business cycle. For example, there is evidence that stock prices tend to move about six months ahead of the economy. In fact, stock prices are a leading indicator for the economy.

Over the course of a business cycle, this approach to investing would work roughly as follows. As the top of a business cycle is perceived to be approaching, stocks purchased should not be vulnerable to a recession. When a downturn is perceived to be at hand, stock holdings should be reduced, with proceeds invested in fixed-income securities. Once the recession has matured to some extent, and interest rates fall, bond prices will rise. As it is perceived that the recession is about to end, profits should be taken in the bonds and proceeds reinvested in stocks, particularly stocks with high beta that are in cyclical industries.

Abnormal returns will generally be earned only if these asset allocation switches are timed better than those of other investors. Switches made after the turning points may not lead to excess returns.

b. Based on the business cycle approach to investment timing, the ideal time to invest in a cyclical stock like a passenger car company would be just before the end of a recession. If the recovery is already underway, Adams's recommendation would be too late. The equities market generally anticipates changes in the economic cycle. Therefore, since the "recovery is underway," the price of Universal Auto should already reflect the anticipated improvements in the economy.

CFA 4

a.
- The industry-wide ROE is leveling off, indicating that the industry may be approaching a later stage of the life cycle.
- Average P/E ratios are declining, suggesting that investors are becoming less optimistic about growth prospects.
- Dividend payout is increasing, suggesting that the firm sees less reason to reinvest earnings in the firm. There may be fewer growth opportunities in the industry.
- Industry dividend yield is also increasing, even though market dividend yield is decreasing.

b.
- Industry growth rate is still forecast at 10 – 15%, higher than would be true of a mature industry.
- Non-U.S. markets are still untapped, and some firms are now entering these markets.
- Mail order sale segment is growing at 40% a year.
- Niche markets are continuing to develop.
- New manufacturers continue to enter the market.

CFA 5

The Threat of New Entrants – Wade will have a somewhat strong position for the coming year and up to three years since they have a three year license from the owners of the patent on the new technology. After three years, both the license expires and the similar products will be in the market. In five years they will likely experience a weak position relative to the threat of new entrants.

Threat of Substitute Products – For the near term, Wade should experience relatively low threats from substitute products. It will take about one year for competitors to incorporate the automatic language conversion feature and thus create substitute products. At five years Wade will likely have a weak position relative to substitute products. For now, their position is strong, but will become much weaker in one year.

The Intensity of Competitive Rivalry – The switch from pari-copper to ordinary copper offers Wade a short term competitive advantage in both product differentiation and pricing. Since ordinary copper costs less than pari-copper, they are able to produce their product cheaper and thus be more competitive. As the license expires it is possible that someone else will enter the market or the license will be sold to numerous companies. Thus, at five years, the advantage in this area will likely be very weak or disappear.

CFA 6

a.	(4)
b.	(3)
c.	(3)
d.	(2)
e.	(4)
f.	(3)
g.	(1)

1. Theoretically, dividend discount models can be used to value the stock of rapidly growing companies that do not currently pay dividends; in this scenario, we would be valuing expected dividends in the relatively more distant future. However, as a practical matter, such estimates of payments to be made in the more distant future are notoriously inaccurate, rendering dividend discount models problematic for valuation of such companies; free cash flow models are more likely to be appropriate. At the other extreme, one would be more likely to choose a dividend discount model to value a mature firm paying a relatively stable dividend.

2. It is most important to use multi-stage dividend discount models when valuing companies with temporarily high growth rates. These companies tend to be companies in the early phases of their life cycles, when they have numerous opportunities for reinvestment, resulting in relatively rapid growth and relatively low dividends (or, in many cases, no dividends at all). As these firms mature, attractive investment opportunities are less numerous so that growth rates slow.

3. The intrinsic value of a share of stock is the individual investor's assessment of the true worth of the stock. The market capitalization rate is the market consensus for the required rate of return for the stock. If the intrinsic value of the stock is equal to its price, then the market capitalization rate is equal to the expected rate of return. On the other hand, if the individual investor believes the stock is underpriced (i.e., intrinsic value < price), then that investor's expected rate of return is greater than the market capitalization rate.

4. MV = 10 + 90 = 100 mil
    BV = 10 + 60 – 40 = 30 mil
    MV / BV = 100 / 30 = 3.33

5. g = .6 x .10 = .06
    price = 2 / (.08 - .06) = 100
    P/E = 100 / 5 = 50

6. k = .04 + .75 (.12-.04) = .10
    Price = 4 / (.10 - .04) = 66.66

7. Price with no growth = 6 / .10 = 60

    g = .60 x .15 = .09
    Price with growth = 2.40 / (.10 - .09) = 240

    PVGO = 240 – 60 = 180

8.

300	EBIT
105	-Taxes
195	Net Income
20	+ depreciation
60	- CapEx
30	- increase in WC
125	FCF

9.

FCFE = 205 – 22 x (1 - .35) + 3 = 193.70

Value = 193.70 / (.12 - .03) = $2,152.22

10. P = $2.10/0.11 = $19.09

11. <u>High-Flyer stock</u>

$$k = r_f + \beta (k_M - r_f) = 5\% + 1.5(10\% - 5\%) = 12.5\%$$

Therefore:

$$P_0 = \frac{D_1}{k - g} = \frac{\$2.50}{0.125 - 0.04} = \$29.41$$

12.

e. False. Higher beta means that the risk of the firm is higher and the discount rate applied to value cash flows is higher. For any expected path of earnings and cash flows, the present value of the cash flows, and therefore, the price of the firm will be lower when risk is higher. Thus the ratio of price to earnings will be lower.

f. True. Higher ROE means more valuable growth opportunities.

g. Uncertain. The answer depends on a comparison of the expected rate of return on reinvested earnings with the market capitalization rate. If the expected rate of return on the firm's projects is higher than the market capitalization rate, then P/E will increase as the plowback ratio increases.

13.

a. $$P_0 = \frac{D_1}{k - g}$$

$$\$50 = \frac{\$2}{0.16 - g} \implies g = 0.16 - \frac{\$2}{\$50} = 0.12 = 12\%$$

b. $\quad P_0 = \dfrac{D_1}{k - g} = \dfrac{\$2}{0.16 - 0.05} = \$18.18$

The price falls in response to the more pessimistic forecast of dividend growth. The forecast for *current* earnings, however, is unchanged. Therefore, the P/E ratio decreases. The lower P/E ratio is evidence of the diminished optimism concerning the firm's growth prospects.

14.

a. $\quad g = ROE \times b = 0.20 \times 0.30 = 0.06 = 6.0\%$

$\quad D_1 = \$2(1 - b) = \$2(1 - 0.30) = \$1.40$

$$P_0 = \frac{D_1}{k - g} = \frac{\$1.40}{0.12 - 0.06} = \$23.33$$

$\quad P/E = \$23.33/\$2 = 11.67$

b. $\quad PVGO = P_0 - \dfrac{E_0}{k} = \$23.33 - \dfrac{\$2.00}{0.12} = \$6.66$

c. $\quad g = ROE \times b = 0.20 \times 0.20 = = 0.04 = 4.0\%$

$\quad D_1 = \$2(1 - b) = \$2(1 - 0.20) = \$1.60$

$$P_0 = \frac{D_1}{k - g} = \frac{\$1.60}{0.12 - 0.04} = \$20.00$$

$\quad P/E = \$20/\$2 = 10.0$

$$PVGO = P_0 - \frac{E_0}{k} = \$20.00 - \frac{\$2.00}{0.12} = \$3.33$$

15.

a. $\quad g = ROE \times b = 0.16 \times 0.5 = 0.08 = 8.0\%$

$\quad D_1 = \$2(1 - b) = \$2(1 - 0.50) = \$1.00$

$$P_0 = \frac{D_1}{k - g} = \frac{\$1.00}{0.12 - 0.08} = \$25.00$$

b. $\quad P_3 = P_0(1 + g)^3 = \$25(1.08)^3 = \$31.49$

16.

a. $k = r_f + \beta (k_M - r_f) = 6\% + 1.25(14\% - 6\%) = 16\%$

$g = (2/3) \times 9\% = 6\%$

$D_1 = E_0 \times (1 + g) \times (1 - b) = \$3 \times 1.06 \times (1/3) = \$1.06$

$$P_0 = \frac{D_1}{k - g} = \frac{\$1.06}{0.16 - 0.06} = \$10.60$$

b. Leading $P_0/E_1 = \$10.60/\$3.18 = 3.33$

Trailing $P_0/E_0 = \$10.60/\$3.00 = 3.53$

c. $\text{PVGO} = P_0 - \dfrac{E_0}{k} = \$10.60 - \dfrac{\$3}{0.16} = -\$8.15$

The low P/E ratios and negative PVGO are due to a poor ROE (9%) that is less than the market capitalization rate (16%).

h. Now, you revise the following:

$b = 1/3$

$g = 1/3 \times 0.09 = 0.03 = 3.0\%$

$D_1 = E_0 \times 1.03 \times (2/3) = \$2.06$

$$V_0 = \frac{D_1}{k - g} = \frac{\$2.06}{0.16 - 0.03} = \$15.85$$

V_0 increases because the firm pays out more earnings instead of reinvesting earnings at a poor ROE. This information is not yet known to the rest of the market.

17. FI Corporation

a. $P_0 = \dfrac{D_1}{k - g} = \dfrac{\$8.00}{0.10 - 0.05} = \$160.00$

b. The dividend payout ratio is $8/12 = 2/3$, so the plowback ratio is $b = (1/3)$. The implied value of ROE on future investments is found by solving as follows:

$g = b \times \text{ROE}$

$0.05 = (1/3) \times \text{ROE} \Rightarrow \text{ROE} = 15\%$

c. Assuming $\text{ROE} = k$, the price is $(E_1/k) \Rightarrow P_0 = \$12/0.10 = \$120$

Therefore, the market is paying $(\$160 - \$120) = \$40$ per share for growth opportunities.

18. <u>Nogro Corporation</u>

   a. $D_1 = 0.5 \times \$2 = \$1$

      $g = b \times ROE = 0.5 \times 0.20 = 0.10$

      Therefore:

      $$k = \frac{D_1}{P_0} + g = \frac{\$1}{\$10} + 0.10 = 0.20 = 20.0\%$$

   b. Since k = ROE, the NPV of future investment opportunities is zero:

      $$PVGO = P_0 - \frac{E_0}{k} = \$10 - \$10 = \$0$$

   c. Since k = ROE, the stock price would be unaffected if Nogro were to cut its dividend payout ratio to 25%. The additional earnings that would be reinvested would earn the ROE (20%).

      Again, if Nogro eliminated the dividend, this would have no impact on Nogro's stock price since the NPV of the additional investments would be zero.

19. <u>Xyrong Corporation</u>

   a. $k = r_f + \beta[E(r_M) - r_f] = 8\% + 1.2(15\% - 8\%) = 16.4\%$

      $g = b \times ROE = 0.6 \times 0.20 = 12\%$

      $$V_0 = \frac{D_0 \times (1+g)}{k-g} = \frac{\$4 \times 1.12}{0.164 - 0.12} = \$101.82$$

   b. $P_1 = V_1 = V_0 \times (1 + g) = \$101.82 \times 1.12 = \$114.04$

      $$E(r) = \frac{D_1 + P_1 - P_0}{P_0} = \frac{\$4.48 + \$114.04 - \$100}{\$100} = 0.1852 = 18.52\%$$

20.
Before-tax cash flow from operations	$2,100,000
Depreciation	210,000
Taxable Income	1,890,000
Taxes (@ 35%)	661,500
After-tax unleveraged income	1,228,500
After-tax cash flow from operations	
(After-tax unleveraged income + depreciation)	1,438,500
New investment (20% of cash flow from operations)	420,000
Free cash flow	
(After-tax cash flow from operations – new investment)	$1,018,500

The value of the firm (i.e., debt plus equity) is:

$$V_0 = \frac{C_1}{k-g} = \frac{\$1,018,500}{0.12-0.05} = \$14,550,000$$

Since the value of the debt is $4 million, the value of the equity is $10,550,000.

21.

a. Price = 20.62

b. Price = 18.95

c. Price = 20.07

Use this spreadsheet for all answers

Inputs		Year	Dividend	Div growth	Term value	Investor CF
beta	1.05	2009	0.90			0.90
mkt_prem	0.085	2010	0.98			0.98
rf	0.035	2011	1.07			1.07
k_equity	0.12425	2012	1.15			1.15
plowback	0.7	2013	1.25	0.0851		1.25
ROE	0.11	2014	1.35	0.0843		1.35
term_gwth	0.077	2015	1.47	0.0835		1.47
		2016	1.59	0.0827		1.59
		2017	1.72	0.0819		1.72
		2018	1.86	0.0811		1.86
		2019	2.01	0.0803		2.01
		2020	2.16	0.0794		2.16
		2021	2.34	0.0786		2.34
		2022	2.52	0.0778		2.52
		2023	2.71	0.0770		2.71
		2024	2.92	0.0770	66.54	69.46

Price = $20.07

22. The solutions derived from Spreadsheet 13.2 are as follows:

a.

	J	K	L
36	**Intrinsic val**	**Equity val**	**Intrin/share**
37	73,759	54,759	30.25
38	56,058	56,058	30.97

b.

	J	K	L
36	**Intrinsic val**	**Equity val**	**Intrin/share**
37	69,383	50,383	27.84
38	52,638	52,638	29.08

c.

	J	K	L
36	Intrinsic val	Equity val	Intrin/share
37	69,529	50,529	27.92
38	52,762	52,762	29.15

23.

a. $g = \text{ROE} \times b = 20\% \times 0.5 = 10\%$

$$P_0 = \frac{D_1}{k-g} = \frac{D_0(1+g)}{k-g} = \frac{\$0.50 \times 1.10}{0.15 - 0.10} = \$11$$

b.

Time	EPS	Dividend	Comment
0	$1.0000	$0.5000	
1	$1.1000	$0.5500	g = 10%, plowback = 0.50
2	$1.2100	$0.7260	EPS has grown by 10% based on last year's earnings plowback and ROE; this year's earnings plowback ratio now falls to 0.40 and payout ratio = 0.60
3	$1.2826	$0.7696	EPS grows by (0.4) (15%) = 6% and payout ratio = 0.60

At time 2: $P_2 = \dfrac{D_3}{k-g} = \dfrac{\$0.7696}{0.15 - 0.06} = \$8.551$

At time 0: $V_0 = \dfrac{\$0.55}{1.15} + \dfrac{\$0.726 + \$8.551}{(1.15)^2} = \$7.493$

c. $P_0 = \$11$ and $P_1 = P_0(1 + g) = \$12.10$

(Because the market is unaware of the changed competitive situation, it believes the stock price should grow at 10% per year.)

$P_2 = \$8.551$ *after* the market becomes aware of the changed competitive situation.

$P_3 = \$8.551 \times 1.06 = \$9.064$ (The new growth rate is 6%.)

Year	Return
1	$\dfrac{(\$12.10 - \$11) + \$0.55}{\$11} = 0.150 = 15.0\%$
2	$\dfrac{(\$8.551 - \$12.10) + \$0.726}{\$12.10} = -0.233 = -23.3\%$
3	$\dfrac{(\$9.064 - \$8.551) + \$0.7696}{\$8.551} = 0.150 = 15.0\%$

Moral: In "normal periods" when there is no special information,
the stock return = k = 15%. When special information arrives, all the abnormal
return accrues *in that period*, as one would expect in an efficient market.

CFA 1
   (a) and (b)

CFA 2

a. This director is confused. In the context of the constant growth model, it is true that price is higher when dividends are higher *holding everything else (including dividend growth) constant*. But everything else will not be constant. If the firm raises the dividend payout rate, then the growth rate (g) will fall, and stock price will not necessarily rise.   In fact, if ROE > k, price will fall.

b. i. An increase in dividend payout reduces the sustainable growth rate as less funds are reinvested in the firm.

   ii. The sustainable growth rate is (ROE × plowback), which falls as the plowback ratio falls. The increased dividend payout rate reduces the growth rate of book value for the same reason -- less funds are reinvested in the firm.

CFA 3

a. It is true that NewSoft sells at higher multiples of earnings and book value than Capital. But this difference may be justified by NewSoft's higher expected growth rate of earnings and dividends. NewSoft is in a growing market with abundant profit and growth opportunities. Capital is in a mature industry with fewer growth prospects. Both the price-earnings and price-book ratios reflect the prospect of growth opportunities, indicating that the ratios for these firms do not necessarily imply mispricing.

b. The most important weakness of the constant-growth dividend discount model in this application is that it assumes a perpetual constant growth rate of dividends. While dividends may be on a steady growth path for Capital, which is a more mature firm, that is far less likely to be a realistic assumption for NewSoft.

c. NewSoft should be valued using a multi-stage DDM, which allows for rapid growth in the early years, but also recognizes that growth must ultimately slow to a more sustainable rate.

CFA 4

a. The industry's estimated P/E can be computed using the following model:

$$P_0/E_1 = \text{payout ratio}/(r - g)$$

However, since r and g are not explicitly given, they must be computed using the following formulas:

$$g_{ind} = \text{ROE} \times \text{retention rate} = 0.25 \times 0.40 = 0.10$$

$$r_{ind} = \text{government bond yield} + (\text{ industry beta} \times \text{equity risk premium})$$

$$= 0.06 + (1.2 \times 0.05) = 0.12$$

Therefore:

$$P_0/E_1 = 0.60/(0.12 - 0.10) = 30.0$$

b.

(i)   Forecast growth in real GDP would cause P/E ratios to be generally higher for Country A.   Higher expected growth in GDP implies higher earnings growth and a higher P/E.

(ii)   ii. Government bond yield would cause P/E ratios to be generally higher for Country B. A lower government bond yield implies a lower risk-free rate and therefore a higher P/E.

(iii)   iii. Equity risk premium would cause P/E ratios to be generally higher for Country B. A lower equity risk premium implies a lower required return and a higher P/E.

CFA 5

a. $k = r_f + \beta\ [E(r_M) - r_f] = 4.5\% + 1.15(14.5\% - 4.5\%) = 16\%$

b.

Year	Dividends	
2007	$1.72	
2008	1.72×1.12	= $1.93
2009	1.72×1.12^2	= $2.16
2010	1.72×1.12^3	= $2.42
2011	$1.72 \times 1.12^3 \times 1.09$	= $2.63

Present value of dividends paid in years 2008 to 20010:

Year	PV of Dividends
2008	$1.93/1.16^1 = 1.66
2009	$2.16/1.16^2 = 1.61

2010 $\$2.42/1.16^3 = \underline{\$1.55}$
            Total: $\$4.82$

$$P_{2010} = \frac{D_{2003}}{k-g} = \frac{\$2.63}{0.16 - 0.09} = \$37.57$$

PV (in 2007) of $P_{2010} = \$37.57/(1.16^3) = \$24.07$

Intrinsic value of stock $= \$4.82 + \$24.07 = \$28.89$

d. The table presented in the problem indicates that Quick Brush is selling below intrinsic value, while we have just shown that Smile White is selling somewhat above the estimated intrinsic value. Based on this analysis, Quick Brush offers the potential for considerable abnormal returns, while Smile White offers slightly below-market risk-adjusted returns.

e. Strengths of two-stage DDM compared to constant growth DDM:

- The two-stage model allows for separate valuation of two distinct periods in a company's future. This approach can accommodate life cycle effects. It also can avoid the difficulties posed when the initial growth rate is higher than the discount rate.

- The two-stage model allows for an initial period of above-sustainable growth. It allows the analyst to make use of her expectations as to when growth may shift to a more sustainable level.

- A weakness of all DDMs is that they are all very sensitive to input values. Small changes in k or g can imply large changes in estimated intrinsic value. These inputs are difficult to measure.

CFA 6

a. The value of a share of Rio National equity using the Gordon growth model and the capital asset pricing model is $22.40, as shown below.

Calculate the required rate of return using the capital asset pricing model:

$$k = r_f + \beta (k_M - r_f) = 4\% + 1.8(9\% - 4\%) = 13\%$$

Calculate the share value using the Gordon growth model:

$$P_0 = \frac{D_o \times (1+g)}{k-g} = \frac{\$0.20 \times (1+0.12)}{0.13 - 0.12} = \$22.40$$

b. The sustainable growth rate of Rio National is 9.97%, calculated as follows:

$g = b \times ROE =$ Earnings Retention Rate $\times ROE = (1 - $ Payout Ratio$) \times ROE =$

$$\left(1 - \frac{\text{Dividends}}{\text{Net Income}}\right) \times \frac{\text{Net Income}}{\text{Beginning Equity}} = \left(1 - \frac{\$3.20}{\$30.16}\right) \times \frac{\$30.16}{\$270.35} = 0.0997 = 9.97\%$$

CFA 7

    a. To obtain free cash flow to equity (FCFE), the two adjustments that Shaar should make to cash flow from operations (CFO) are:

       1. Subtract investment in fixed capital: CFO does not take into account the investing activities in long-term assets, particularly plant and equipment. The cash flows corresponding to those necessary expenditures are not available to equity holders and therefore should be subtracted from CFO to obtain FCFE.

       2. Add net borrowing: CFO does not take into account the amount of capital supplied to the firm by lenders (e.g., bondholders). The new borrowings, net of debt repayment, are cash flows available to equity holders and should be added to CFO to obtain FCFE.

    b. *Note 1*: Rio National had $75 million in capital expenditures during the year.
Adjustment: negative $75 million
The cash flows required for those capital expenditures (–$75 million) are no longer available to the equity holders and should be subtracted from net income to obtain FCFE.

Note 2: A piece of equipment that was originally purchased for $10 million was sold for $7 million at year-end, when it had a net book value of $3 million. Equipment sales are unusual for Rio National.
Adjustment: positive $3 million
In calculating FCFE, only cash flow investments in fixed capital should be considered. The $7 million sale price of equipment is a cash inflow now available to equity holders and should be added to net income. However, the gain over book value that was realized when selling the equipment ($4 million) is already included in net income. Because the total sale is cash, not just the gain, the $3 million net book value must be added to net income. Therefore, the adjustment calculation is:

$7 million in cash received – $4 million of gain recorded in net income = $3 million additional cash received that must be added to net income to obtain FCFE.

Note 3: The decrease in long-term debt represents an unscheduled principal repayment; there was no new borrowing during the year.
Adjustment: negative $5 million
The unscheduled debt repayment cash flow (–$5 million) is an amount no longer available to equity holders and should be subtracted from net income to determine FCFE.

Note 4: On 1 January 2009, the company received cash from issuing 400,000 shares of common equity at a price of $25.00 per share.
No adjustment
Transactions between the firm and its shareholders do not affect FCFE. To calculate FCFE, therefore, no adjustment to net income is required with respect to the issuance of new shares.

Note 5: A new appraisal during the year increased the estimated market value of land held for investment by $2 million, which was not recognized in 2009 income.
No adjustment
The increased market value of the land did not generate any cash flow and was not reflected in net income. To calculate FCFE, therefore, no adjustment to net income is required.

c. Free cash flow to equity (FCFE) is calculated as follows:

FCFE = NI + NCC – FCINV – WCINV + Net Borrowing
where NCC = non-cash charges
       FCINV = investment in fixed capital
       WCINV = investment in working capital

	Million $	Explanation
NI =	$30.16	From Exhibit 18B
NCC =	+$67.17	$71.17 (depreciation and amortization from Exhibit 18B) – $4.00* (gain on sale from Note 2)
FCINV =	–$68.00	$75.00 (capital expenditures from Note 1) – $7.00* (cash on sale from Note 2)
WCINV =	–$24.00	–$3.00 (increase in accounts receivable from Exhibit 18A + –$20.00 (increase in inventory from Exhibit 18A) + –$1.00 (decrease in accounts payable from Exhibit 18A)
Net Borrowing =	+(–$5.00)	–$5.00 (decrease in long-term debt from Exhibit 18A)
FCFE =	$0.33	

*Supplemental Note 2 in Exhibit 18C affects both NCC and FCINV.

CFA 8
Rio National's equity is relatively undervalued compared to the industry on a P/E-to-growth (PEG) basis. Rio National's PEG ratio of 1.33 is below the industry PEG ratio of 1.66. The lower PEG ratio is attractive because it implies that the growth rate at Rio National is available at a relatively lower price than is the case for the industry. The PEG ratios for Rio National and the industry are calculated below:

<u>Rio National</u>

Current Price = $25.00

Normalized Earnings per Share = $1.71

Price-to-Earnings Ratio = $25/$1.71 = 14.62

Growth Rate (as a percentage) = 11

PEG Ratio = 14.62/11 = 1.33

<u>Industry</u>

Price-to-Earnings Ratio = 19.90

Growth Rate (as a percentage) = 12

PEG Ratio = 19.90/12 = 1.66

CFA 9

Using a two-stage dividend discount model, the current value of a share of Sundanci is calculated as follows:

$$V_0 = \frac{D_1}{(1+k)^1} + \frac{D_2}{(1+k)^2} + \frac{\dfrac{D_3}{(k-g)}}{(1+k)^2}$$

$$= \frac{\$0.3770}{1.14^1} + \frac{\$0.4976}{1.14^2} + \frac{\dfrac{\$0.5623}{(0.14-0.13)}}{1.14^2} = \$43.98$$

where:

$E_0 = \$0.952$

$D_0 = \$0.286$

$E_1 = E_0 (1.32)^1 = \$0.952 \times 1.32 = \$1.2566$

$D_1 = E_1 \times 0.30 = \$1.2566 \times 0.30 = \$0.3770$

$E_2 = E_0 (1.32)^2 = \$0.952 \times (1.32)^2 = \$1.6588$

$D_2 = E_2 \times 0.30 = \$1.6588 \times 0.30 = \$0.4976$

$E_3 = E_0 \times (1.32)^2 \times 1.13 = \$0.952 \times (1.32)^3 \times 1.13 = \$1.8744$

$D_3 = E_3 \times 0.30 = \$1.8744 \times 0.30 = \$0.5623$

CFA 10

a. Free cash flow to equity (FCFE) is defined as the cash flow remaining after meeting all financial obligations (including debt payment) and after covering capital expenditure and working capital needs. The FCFE is a measure of how much the firm can afford to pay out as dividends, but in a given year may be more or less than the amount actually paid out.

Sundanci's FCFE for the year 2010 is computed as follows:

FCFE =

Earnings after tax + Depreciation expense − Capital expenditures − Increase in NWC

= $80 million + $23 million − $38 million − $41 million = $24 million

FCFE per share = FCFE/number of shares outstanding =

$24 million/84 million shares = $0.286

At the given dividend payout ratio, Sundanci's FCFE per share equals dividends per share.

b. The FCFE model requires forecasts of FCFE for the high growth years (2011 and 2012) plus a forecast for the first year of stable growth (2013) in order to allow for an estimate of the terminal value in 2012 based on perpetual growth. Because all of the components of FCFE are expected to grow at the same rate, the values can be obtained by projecting the FCFE at the common rate. (Alternatively, the components of FCFE can be projected and aggregated for each year.)

The following table shows the process for estimating Sundanci's current value on a per share basis:

Free Cash Flow to Equity

Base Assumptions
Shares outstanding: 84 millions
Required return on equity (r): 14%

			Actual 2010	Projected 2011	Projected 2012	Projected 2013
Growth rate (g)				27%	27%	13%
	Total	Per share				
Earnings after tax	$80	$0.952	$1.2090	$1.5355		$1.7351
Plus: Depreciation expense	$23	$0.274	$0.3480	$0.4419		$0.4994
Less: Capital expenditures	$38	$0.452	$0.5740	$0.7290		$0.8238
Less: Increase in net working capital	$41	$0.488	$0.6198	$0.7871		$0.8894
Equals: FCFE	$24	$0.286	$0.3632	$0.4613		$0.5213
Terminal value					$52.1300*	
Total cash flows to equity				$0.3632	$52.5913**	
Discounted value				$0.3186***	$40.4673***	
Current value per share					$40.7859****	

*Projected 2012 Terminal value = (Projected 2013 FCFE)/(r – g)

**Projected 2012 Total cash flows to equity =

Projected 2012 FCFE + Projected 2012 Terminal value

***Discounted values obtained using r = 14%

****Current value per share =

Sum of Discounted Projected 2011 and 2012 Total cash flows to equity

c. i. The following limitations of the dividend discount model (DDM) are addressed by the FCFE model. The DDM uses a strict definition of cash flows to equity, i.e. the expected dividends on the common stock. In fact, taken to its extreme, the DDM cannot be used to estimate the value of a stock that pays no dividends. The FCFE model expands the definition of cash flows to include the balance of residual cash flows after all financial obligations and investment needs have been met. Thus the FCFE model explicitly recognizes the firm's investment and financing policies as well as its dividend policy. In instances of a change of corporate control, and therefore the possibility of changing dividend policy, the FCFE model provides a better estimate of value. The DDM is biased toward finding low PIE ratio stocks with high dividend yields to be undervalued and conversely, high PIE ratio stocks with low dividend yields to be overvalued. It is considered a conservative model in that it tends to identify fewer undervalued firms as market prices rise relative to fundamentals. The DDM does not allow for the potential tax disadvantage of high dividends relative to the capital gains achievable from retention of earnings.

ii. The following limitations of the DDM are not addressed by the FCFE model. Both two-stage valuation models allow for two distinct phases of growth, an initial finite period where the growth rate is abnormal, followed by a stable growth period that is expected to last indefinitely.. These two-stage models share the same limitations with respect to the growth assumptions. First, there is the difficulty of defining the duration of the extraordinary growth period. For example, a longer period of high growth will lead to a higher valuation, and there is the temptation to assume an unrealistically long period of extraordinary growth. Second, the assumption of a sudden shift form high growth to lower, stable growth is unrealistic. The transformation is more likely to occur gradually, over a period of time. Given that the assumed total horizon does not shift (i.e., is infinite), the timing of the shift form high to stable growth is a critical determinant of the valuation estimate. Third, because the value is quite sensitive to the steady-state growth assumption, over- or under-estimating this rate can lead to large errors in value. The two models share other limitations as well, notably difficulties inaccurately forecasting required rates of return, in dealing with the distortions that result from substantial and/or volatile debt ratios, and in accurately valuing assets that do not generate any cash flows.

CFA 11

a. The formula for calculating a price earnings ratio (P/E) for a stable growth firm is the dividend payout ratio divided by the difference between the required rate of return and the growth rate of dividends. If the P/E is calculated based on trailing earnings (year 0), the payout ratio is increased by the growth rate. If the P/E is calculated based on next year's earnings (year 1), the numerator is the payout ratio.

P/E on trailing earnings:

$$P/E = [\text{payout ratio} \times (1 + g)]/(r - g) = [0.30 \times 1.13]/(0.14 - 0.13) = 33.9$$

P/E on next year's earnings:

P/E = payout ratio/(r − g) = 0.30/(0.14 − 0.13) = 30.0

b. The P/E ratio is a decreasing function of riskiness; as risk increases the P/E ratio decreases. Increases in the riskiness of Sundanci stock would be expected to lower the P/E ratio.

The P/E ratio is an increasing function of the growth rate of the firm; the higher the expected growth the higher the P/E ratio. Sundanci would command a higher P/E if analysts increase the expected growth rate.

The P/E ratio is a decreasing function of the market risk premium. An increased market risk premium would increase the required rate of return, lowering the price of a stock relative to its earnings. A higher market risk premium would be expected to lower Sundanci's P/E ratio.

CHAPTER 18
PORTFOLIO PERFORMANCE EVALUATION

1. a. Possibly. Alpha alone does not determine which portfolio has a larger Sharpe ratio. Sharpe measure is the primary factor, since it tells us the real return per unit of risk. We only invest if the Sharpe measure is higher. The standard deviation of an investment and its correlation with the benchmark are also important. Thus positive alpha is not a sufficient condition for a managed portfolio to offer a higher Sharpe measure than the passive benchmark.
b. Yes. It is possible for a positive alpha to exist, but the Sharpe measure decline. Thus, we would experience inferior performance.

2. Maybe. Provided the addition of funds creates an efficient frontier with the existing investments, and assuming the Sharpe measure increases, the answer is yes. Otherwise, no.

3. The M-squared is an equivalent representation of the Sharpe measure, with the added difference of providing a risk-adjusted measure of performance that can be easily interpreted as a differential return relative to a benchmark. Thus, it provides the same information as the Sharpe measure. But in a different format.

4. Definitely, the FF model. Research shows that passive investments (e.g., a market index portfolio) will appear to have a zero alpha when evaluated using the multi-index model but not using the single-index one. The nonzero alpha appears even in the absence of superior performance. Thus, the single-index alpha can be misleading.

5.
    i.

	E(r)	σ	β
Portfolio A	11%	10%	0.8
Portfolio B	14%	31%	1.5
Market index	12%	20%	1.0
Risk-free asset	6%	0%	0.0

The alphas for the two portfolios are:

$$\alpha_A = 11\% - [6\% + 0.8(12\% - 6\%)] = 0.2\%$$

$$\alpha_B = 14\% - [6\% + 1.5(12\% - 6\%)] = -1.0\%$$

Ideally, you would want to take a long position in Portfolio A and a short position in Portfolio B.

j.   If you hold only one of the two portfolios, then the Sharpe measure is the appropriate criterion:

$$S_A = \frac{11-6}{10} = 0.5$$

$$S_B = \frac{14-6}{31} = 0.26$$

Therefore, using the Sharpe criterion, Portfolio A is preferred.

6. We first distinguish between timing ability and selection ability. The intercept of the scatter diagram is a measure of stock selection ability. If the manager tends to have a positive excess return even when the market's performance is merely "neutral" (i.e., the market has zero excess return) then we conclude that the manager has, on average, made good stock picks. In other words, stock selection must be the source of the positive excess returns.

Timing ability is indicated by the curvature of the plotted line. Lines that become steeper as you move to the right of the graph show good timing ability. The steeper slope shows that the manager maintained higher portfolio sensitivity to market swings (i.e., a higher beta) in periods when the market performed well. This ability to choose more market-sensitive securities in anticipation of market upturns is the essence of good timing. In contrast, a declining slope as you move to the right indicates that the portfolio was more sensitive to the market when the market performed poorly, and less sensitive to the market when the market performed well. This indicates poor timing.

We can therefore classify performance ability for the four managers as follows:

	Selection Ability	Timing Ability
A	Bad	Good
B	Good	Good
C	Good	Bad
D	Bad	Bad

7.

k.   Actual: $(0.70 \times 2.0\%) + (0.20 \times 1.0\%) + (0.10 \times 0.5\%) = 1.65\%$

Bogey: $(0.60 \times 2.5\%) + (0.30 \times 1.2\%) + (0.10 \times 0.5\%) = 1.91\%$

*Under*performance $= 1.91\% - 1.65\% = 0.26\%$

l. Security Selection:

Market	Portfolio Performance	Index Performance	Excess Performance	Manager's Portfolio Weight	Contribution
Equity	2.0%	2.5%	-0.5%	0.70	-0.35%
Bonds	1.0%	1.2%	-0.2%	0.20	-0.04%
Cash	0.5%	0.5%	0.0%	0.10	0.00%
			Contribution of security selection:		-0.39%

m. Asset Allocation:

Market	Actual Weight	Benchmark Weight	Excess Weight	Index Return Minus Bogey	Contribution
Equity	0.70	0.60	0.10	0.59%	0.059%
Bonds	0.20	0.30	-0.10	-0.71%	0.071%
Cash	0.10	0.10	0.00	-1.41%	0.000%
			Contribution of asset allocation:		0.130%

Summary	
Security selection	-0.39%
Asset allocation	0.13%
Excess performance	-0.26%

8. Support: A manager could be a better forecaster in one scenario than another. For example, a high-beta manager will do better in up markets and worse in down markets. Therefore, we should observe performance over an entire cycle. Also, to the extent that observing a manager over an entire cycle increases the number of observations, it would improve the reliability of the measurement.

Contradict: If we adequately control for exposure to the market (i.e., adjust for beta), then market performance should not affect the relative performance of individual managers. It is therefore not necessary to wait for an entire market cycle to pass before you evaluate a manager.

9. It does, to some degree. If those manager groups are sufficiently homogeneous with respect to style, then relative performance is a decent benchmark. However, one would like to be able to adjust for the additional variation in style or risk choice that remains among managers in any comparison group. In addition, investors might prefer an "investable" alternative such as a passive index to which they can compare a manager's performance. After all, passive investors do not have the choice of investing in "the median manager," since the identity of that manager is not known until *after* the investment period.

10. The manager's alpha is: $10\% - [6\% + 0.5(14\% - 6\%)] = 0$

11. The spreadsheet below displays the monthly returns and excess returns for the Vanguard U.S. Growth Fund, the Vanguard U.S. Value Fund and the S&P 500.

Month	Total monthly returns				Excess Returns		
	VUVLX	VWVSX	SPY	T-bills	VUVLX	VWVSX	SPY
Jan-04	1.52	-0.07	1.35	0.07	1.45	-0.14	1.28
Feb-04	-0.53	-0.99	-1.32	0.06	-0.59	-1.05	-1.38
Mar-04	-2.69	-2.46	-1.89	0.09	-2.78	-2.55	-1.98
Apr-04	0.22	2.52	1.70	0.08	0.14	2.44	1.62
May-04	2.53	1.39	1.85	0.06	2.47	1.33	1.79
Jun-04	-1.93	-7.46	-3.22	0.08	-2.01	-7.54	-3.30
Jul-04	0.99	-0.78	0.25	0.1	0.89	-0.88	0.15
Aug-04	1.52	2.49	1.00	0.11	1.41	2.38	0.89
Sep-04	0.21	1.46	1.29	0.11	0.10	1.35	1.18
Oct-04	5.22	4.66	4.46	0.11	5.11	4.55	4.35
Nov-04	3.24	3.60	3.01	0.15	3.09	3.45	2.86
Dec-04	-2.36	-3.48	-2.24	0.16	-2.52	-3.64	-2.40
Jan-05	3.62	0.79	2.09	0.16	3.46	0.63	1.93
Feb-05	-2.33	-2.86	-1.83	0.16	-2.49	-3.02	-1.99
Mar-05	-2.68	-2.41	-1.87	0.21	-2.89	-2.62	-2.08
Apr-05	4.08	7.13	3.22	0.21	3.87	6.92	3.01
May-05	2.25	0.51	0.15	0.24	2.01	0.27	-0.09
Jun-05	3.55	5.28	3.82	0.23	3.32	5.05	3.59
Jul-05	-1.85	-0.85	-0.93	0.24	-2.09	-1.09	-1.17
Aug-05	0.38	1.34	0.80	0.3	0.08	1.04	0.50
Sep-05	-1.88	0.30	-2.36	0.29	-2.17	0.01	-2.65
Oct-05	2.87	5.04	4.39	0.27	2.60	4.77	4.12
Nov-05	0.93	0.46	-0.19	0.31	0.62	0.15	-0.50
Dec-05	3.41	3.30	2.41	0.32	3.09	2.98	2.09
Jan-06	0.00	-1.82	0.57	0.35	-0.35	-2.17	0.22
Feb-06	0.71	0.34	1.65	0.34	0.37	0.00	1.31
Mar-06	0.53	-0.45	1.26	0.37	0.16	-0.82	0.89
Apr-06	-3.00	-5.84	-3.01	0.36	-3.36	-6.20	-3.37
May-06	-0.27	-1.55	0.26	0.43	-0.70	-1.98	-0.17
Jun-06	1.09	-2.36	0.45	0.4	0.69	-2.76	0.05
Jul-06	2.70	3.60	2.18	0.4	2.30	3.20	1.78
Aug-06	2.63	2.87	2.70	0.42	2.21	2.45	2.28
Sep-06	2.56	1.92	3.16	0.41	2.15	1.51	2.75
Oct-06	0.75	1.94	1.99	0.41	0.34	1.53	1.58
Nov-06	2.32	0.22	0.77	0.42	1.90	-0.20	0.35
Dec-06	1.86	2.18	1.51	0.4	1.46	1.78	1.11
Jan-07	-2.30	-1.69	-1.96	0.44	-2.74	-2.13	-2.40
Feb-07	0.81	0.89	1.16	0.38	0.43	0.51	0.78
Mar-07	3.87	2.92	4.42	0.43	3.44	2.49	3.99
Apr-07	3.65	3.37	3.39	0.44	3.21	2.93	2.95
May-07	-2.02	-1.14	-1.46	0.41	-2.43	-1.55	-1.87
Jun-07	-4.74	-0.79	-3.13	0.4	-5.14	-1.19	-3.53

Jul-07	1.12	1.11	1.28	0.4	0.72	0.71	0.88
Aug-07	2.54	4.91	3.88	0.42	2.12	4.49	3.46
Sep-07	0.39	2.19	1.35	0.32	0.07	1.87	1.03
Oct-07	-5.86	-3.90	-3.87	0.32	-6.18	-4.22	-4.19
Nov-07	0.25	0.00	-1.13	0.34	-0.09	-0.34	-1.47
Dec-07	-5.39	-10.34	-6.04	0.27	-5.66	-10.61	-6.31
Jan-08	-2.67	-2.38	-2.58	0.21	-2.88	-2.59	-2.79
Feb-08	-0.89	-0.06	-0.90	0.13	-1.02	-0.19	-1.03
Mar-08	5.64	6.32	4.77	0.17	5.47	6.15	4.60
Apr-08	1.44	3.00	1.51	0.17	1.27	2.83	1.34
May-08	-7.18	-6.25	-8.35	0.17	-7.35	-6.42	-8.52
Jun-08	-1.80	-0.40	-0.90	0.17	-1.97	-0.57	-1.07
Jul-08	1.37	0.45	1.55	0.15	1.22	0.30	1.40
Aug-08	-7.50	-11.63	-9.42	0.12	-7.62	-11.75	-9.54
Sep-08	-18.16	-15.45	-16.52	0.15	-18.31	-15.60	-16.67
Oct-08	-7.16	-7.93	-6.96	0.08	-7.24	-8.01	-7.04
Nov-08	2.70	0.57	0.99	0.02	2.68	0.55	0.97
Dec-08	-10.76	-4.49	-8.22	0.09	-10.85	-4.58	-8.31
				Average	-0.59	-0.60	-0.55
b			SD		4.05	4.21	3.81
c			Beta		1.03	1.02	1.00
d			Sharpe rati		-0.15	-0.14	-0.14
			Alpha		-0.03	-0.04	0.00
			Treynor		-0.57	-0.58	-0.55

a. The excess returns are noted in the spreadsheet.

b. The standard deviations for the U.S Growth Fund and the U.S. Value Fund are 4.21% and 4.05%, respectively, as shown in the Excel spreadsheet above.

c. The betas for the U.S. Growth Fund and the U.S. Value Fund are 1.02 and 1.03, respectively, as shown in the Excel spreadsheets below.

d. The formulas for the three measures are below and results listed above.

Sharpe: $\dfrac{\overline{r}_p - \overline{r}_f}{\sigma_p}$

Treynor: $\dfrac{\overline{r}_p - \overline{r}_f}{\beta_p}$

Jensen: $\alpha_p = \overline{r}_p - \left\{ \overline{r}_f + \beta_p \left(\overline{r}_M - \overline{r}_f \right) \right\}$

SUMMARY OUTPUT VUVLX

Regression Statistics	
Multiple R	0.97
R Square	0.94
Adjusted R Square	0.94
Standard Error	1.02
Observations	60.00

ANOVA

	df	SS	MS	F
Regression	1.00	907.97	907.97	876.67
Residual	58.00	60.07	1.04	
Total	59.00	968.04		

	Coefficients	Standard Error	t Stat	P-value
Intercept	(0.03)	0.13	(0.22)	0.83
SPY	1.03	0.03	29.61	0.00

SUMMARY OUTPUT VWVSX

Regression Statistics	
Multiple R	0.93
R Square	0.86
Adjusted R Square	0.85
Standard Error	1.61
Observations	60.00

ANOVA

	df	SS	MS	F
Regression	1.00	896.12	896.12	343.89
Residual	58.00	151.14	2.61	
Total	59.00	1,047.26		

	Coefficients	Standard Error	t Stat	P-value
Intercept	(0.04)	0.21	(0.17)	0.86
SPY	1.02	0.06	18.54	0.00

12. See the Black-Scholes formula. Substitute:

Current stock price = S_0 = $1.0
Exercise price = $X = (1 + r_f) = 1.01$
Standard deviation = $\sigma = 0.055$
Risk-free interest rate = $r_f = 0.01$
Time to maturity of option = $T = 1$

Recall that $\ln(1 + y)$ is approximately equal to y, for small y, and that $N(-x) = [1 - N(x)]$. Then the value of a call option on $1 of the equity portfolio, with exercise price $X = (1 + r_f)$, is:

$$C = 2N(\sigma/2) - 1$$

N(σ/2) is the cumulative standard normal density for the value of half the standard deviation of the equity portfolio.

$$C = 2N(0.0275) - 1$$

Interpolating from the standard normal table:

$$C = 2[0.5080 + 0.375(0.5160 - 0.5080)] - 1 = 0.0220 = 2.2\%$$

Hence the added value of a perfect timing strategy is 2.2% per month.

13.

    n. Using the relative frequencies to estimate the conditional probabilities P_1 and P_2 for timers A and B, we find:

	Timer A	Timer B
P_1	78/135 = 0.58	86/135 = 0.64
P_2	57/92 = 0.62	50/92 = 0.54
$P^* = P_1 + P_2$ - 1	0.20	0.18

The data suggest that timer A is the better forecaster.

    o. Use the following equation and the answer to Problem 13 to value the imperfect timing services of Timer A and Timer B:

$$C(P^*) = C(P_1 + P_2 - 1)$$

$$C_A(P^*) = 2.2\% \times 0.20 = 0.44\% \text{ per month}$$

$$C_B(P^*) = 2.2\% \times 0.18 = 0.40\% \text{ per month}$$

Timer B's added value is greater by 4 basis points per month.

CFA 1

Answer: d

CFA 2

Using a financial calculator or spreadsheet the rate of return is 16.8%

CFA 3

Using a financial calculator or spreadsheet the internal rate of return is 7.5%

CFA 4

    a. $\alpha_A = 24\% - [12\% + 1.0(21\% - 12\%)] = 3.0\%$

             $\alpha_B = 30\% - [12\% + 1.5(21\% - 12\%)] = 4.5\%$

             $T_A = (24 - 12)/1 = 12$

             $T_B = (30 - 12)/1.5 = 12$

As an addition to a passive diversified portfolio, both A and B are candidates because they both have positive alphas.

b. i. The managers may have been trying to time the market. In that case, the SCL of the portfolios may be non-linear. (ii) One year of data is too small a sample.(iii) The portfolios may have significantly different levels of diversification. If both have the same risk-adjusted return, the less diversified portfolio has a higher exposure to risk because of its higher diversifiable risk. Since the above measure adjusts for systematic risk only, it does not tell the entire story.

CFA 5

a. Indeed, the one year results were terrible, but one year is a poor statistical base from which to draw inferences. Moreover, the fund manager was directed to adopt a long-term horizon. The Board specifically instructed the investment manager to give priority to long term results.

b. The sample of pension funds held a much larger share in equities compared to the Alpine pension fund. The stock and bond indexes indicate that equity returns significantly exceeded bond returns. The Alpine fund manager was explicitly directed to hold down risk, investing at most 25% of fund assets in common stocks. (Alpine's beta was also somewhat defensive.) Alpine should not be held responsible for an asset allocation policy dictated by the client.

c. Over the five-year period, Alpine's alpha, which measures risk-adjusted performance compared to the market, was positive:
$$\alpha = 13.3\% - [7.5\% + 0.9(13.8\% - 7.5\%)] = 0.13\%$$

d. Note that, over the last five years, and particularly the last one year, bond performance has been poor; this is significant because this is the asset class that Alpine had been encouraged to hold. Within this asset class, however, the Alpine fund fared much better than the index, as shown in the last two lines of the table. Moreover, despite the fact that the bond index underperformed both the actuarial return and T-bills, the Alpine fund outperformed both for the five-year period. On a risk-adjusted basis, Alpine's performance *within* each asset class has been superior. The overall disappointing returns were the result of the heavy asset allocation weighting towards bonds, which was the Board's, not the fund manager's, choice.

e. A trustee may not care about the time-weighted return, but that return is more indicative of the manager's performance. After all, the manager has no control over the cash inflow to the fund.

CFA 6

a.

Alpha (α)	Expected excess return
$\alpha_i = r_i - [r_f + \beta_i(r_M - r_f)]$	$E(r_i) - r_f$
$\alpha_A = 20\% - [8\% + 1.3(16\% - 8\%)] = 1.6\%$	$20\% - 8\% = 12\%$
$\alpha_B = 18\% - [8\% + 1.8(16\% - 8\%)] = -4.4\%$	$18\% - 8\% = 10\%$
$\alpha_C = 17\% - [8\% + 0.7(16\% - 8\%)] = 3.4\%$	$17\% - 8\% = 9\%$
$\alpha_D = 12\% - [8\% + 1.0(16\% - 8\%)] = -4.0\%$	$12\% - 8\% = 4\%$

Stocks A and C have positive alphas, whereas stocks B and D have negative alphas.

The residual variances are:

$$\sigma^2(e_A) = 58^2 = 3364$$

$$\sigma^2(e_B) = 71^2 = 5041$$

$$\sigma^2(e_C) = 60^2 = 3600$$

$$\sigma^2(e_D) = 55^2 = 3025$$

b. To construct the optimal risky portfolio, we first determine the optimal active portfolio. Using the Treynor-Black technique, we construct the active portfolio:

	$\dfrac{\alpha}{\sigma^2(e)}$	$\dfrac{\alpha / \sigma^2(e)}{\Sigma \alpha / \sigma^2(e)}$
A	.000476	–0.6142
B	–.000873	1.1265
C	.000944	–1.2181

D	–.001322	1.7058
Total	–.000775	1.0000

Do not be disturbed by the fact that the positive alpha stocks get negative weights and vice versa. The entire position in the active portfolio will turn out to be negative, returning everything to good order.

With these weights, the forecast for the active portfolio is:

$\alpha = [-0.6142 \times 1.6] + [1.1265 \times (-4.4)] - [1.2181 \times 3.4] + [1.7058 \times (-4.0)] = -16.90\%$

$\beta = [-0.6142 \times 1.3] + [1.1265 \times 1.8] - [1.2181 \times 0.70] + [1.7058 \times 1] = 2.08$

The high beta (higher than any individual beta) results from the short positions in the relatively low beta stocks and the long positions in the relatively high beta stocks.

$$\sigma^2(e) = [(-0.6142)^2 \times 3364] + [1.1265^2 \times 5041] + [(-1.2181)^2 \times 3600] + [1.7058^2 \times 3025]$$

$$= 21809.6$$

$$\sigma(e) = 147.68\%$$

Here, again, the levered position in stock B [with the high $\sigma^2(e)$] overcomes the diversification effect, and results in a high residual standard deviation.

The optimal risky portfolio has a proportion w^* in the active portfolio, computed as follows:

$$w_0 = \frac{\alpha / \sigma^2(e)}{[E(r_M) - r_f] / \sigma_M^2} = \frac{-16.90 / 21809.6}{8 / 23^2} = -0.05124$$

The negative position is justified for the reason given earlier.

The adjustment for beta is:

$$w^* = \frac{w_0}{1 + (1-\beta)w_0} = \frac{-0.05124}{1 + (1 - 2.08)(-0.05124)} = -0.0486$$

Because w^* is negative, we end up with a positive position in stocks with positive alphas and vice versa. The position in the index portfolio is:

$$1 - (-0.0486) = 1.0486$$

c. To calculate Sharpe's measure for the optimal risky portfolio we compute the appraisal ratio for the active portfolio and Sharpe's measure for the market portfolio. The appraisal ratio of the *active portfolio* is:

$$A = \alpha / \sigma(e) = -16.90 / 147.68 = -0.1144$$

$$A^2 = 0.0131$$

Hence, the square of Sharpe's measure (S) of the *optimized risky portfolio* is:

$$S^2 = S_M^2 + A^2 = \left(\frac{8}{23}\right)^2 + 0.0131 = 0.1341$$

$$S = 0.3662$$

Compare this to the market's Sharpe measure:

$$S_M = 8/23 = 0.3478$$

The difference is: 0.0184

Note that the only-moderate improvement in performance results from the fact that only a small position is taken in the active portfolio A because of its large residual variance.

We calculate the "Modigliani-squared" (M^2) measure, as follows:

$$E(r_{P*}) = r_f + S_P \, \sigma_M = 8\% + (0.3662 \times 23\%) = 16.423\%$$

$$M^2 = E(r_{P*}) - E(r_M) = 16.423\% - 16\% = 0.423\%$$

CHAPTER 19
GLOBALIZATION AND INTERNATIONAL INVESTING

1. False. Investments made in a local currency have the added risk associated with exchange rates. If an investment were made in dollars, the business risk of the firm would be the only risk born by the investor. If the investment is made in the local currency, the investor takes on both business risk and exchange rate risk.

2. False. In almost all cases the statement is true, however, such diversification benefit is not assured. In those cases where there is no correlation coefficient between the international investment and the US portfolio, a diversification gain cannot be assured. In fact, should a high standard deviation security, with zero or one correlation with the US portfolio were added, the overall standard deviation of the portfolio would increase.

3. False. Evidence shows that the minimum-variance portfolio is not the efficient choice. A capitalization-weighted portfolio of world indexes is likely to produce a better risk-return trade-off than the minimum-variance portfolio.

4. True. By hedging, it is possibly to virtually eliminate exchange rate risk. The result is a set of returns based on the foreign stocks and not the currency fluctuations.

5.
   a. $10,000/2 = £5,000
      £5,000/£40 = 125 shares

   b. To fill in the table, we use the relation:

   $$1 + r(US) = [(1 + r_f(UK)]\frac{E_1}{E_0}$$

Price per Share (£)	Pound-Denominated Return (%)	Dollar-Denominated Return (%) for Year-End Exchange Rate		
		$1.80/£	$2.00/£	$2.20/£
£35	-12.5%	-21.25%	-12.5%	-3.75%
£40	0.0%	-10.00%	0.0%	10.00%
£45	12.5%	1.25%	12.5%	23.75%

   c. The dollar-denominated return equals the pound-denominated return when the exchange rate is unchanged over the year.

6. The standard deviation of the pound-denominated return (using 3 degrees of freedom) is 10.21%. The dollar-denominated return has a standard deviation of 13.10% (using 9 degrees of freedom), greater than the pound-denominated standard deviation. This is due to the addition of exchange rate risk.

7. First we calculate the dollar value of the 125 shares of stock in each scenario. Then we add the profits from the forward contract in each scenario.

Price per Share (£)	Exchange Rate:	Dollar Value of Stock at Given Exchange Rate		
		$1.80/£	$2.00/£	$2.20/£
£35		7,875	8,750	9,625
£40		9,000	10,000	11,000
£45		10,125	11,250	12,375
Profits on Forward Exchange:		1,500	500	-500
$[= 5000(2.10 - E_1)]$				

Price per Share (£)	Exchange Rate:	Total Dollar Proceeds at Given Exchange Rate		
		$1.80/£	$2.00/£	$2.20/£
£35		9,375	9,250	9,125
£40		10,500	10,500	10,500
£45		11,625	11,750	11,875

Finally, calculate the dollar-denominated rate of return, recalling that the initial investment was $10,000:

Price per Share (£)	Exchange Rate:	Rate of return (%) at Given Exchange Rate		
		$1.80/£	$2.00/£	$2.20/£
£35		-6.25%	-7.50%	-8.75%
£40		5.00%	5.00%	5.00%
£45		16.25%	17.50%	18.75%

b.   The standard deviation is now 10.24%. This is lower than the unhedged dollar-denominated standard deviation, and is only slightly higher than the standard deviation of the pound-denominated return.

8. Currency Selection

EAFE: $[0.30 \times (-10\%)] + (0.10 \times 0\%) + (0.60 \times 10\%) = 3.0\%$

Manager: $[0.35 \times (-10\%)] + (0.15 \times 0\%) + (0.50 \times 10\%) = 1.5\%$

Loss of 1.5% relative to EAFE.

Country Selection

EAFE: $(0.30 \times 20\%) + (0.10 \times 15\%) + (0.60 \times 25\%) = 22.50\%$

Manager: $(0.35 \times 20\%) + (0.15 \times 15\%) + (0.50 \times 25\%) = 21.75\%$

Loss of 0.75% relative to EAFE.

<u>Stock Selection</u>

$[(18\% - 20\%) \times 0.35] + [(20\% - 15\%) \times 0.15] + [(20\% - 25\%) \times 0.50] = -2.45\%$

Loss of 2.45% relative to EAFE.

9. $1 + r(US) = [1 + r_f(UK)] \times (F_0/E_0) = 1.08 \times (1.85/1.75) = 1.1417 \Rightarrow r(US) = 14.17\%$

10. You can purchase now: $\$10,000/\$1.75 = £5,714.29$

   This will grow with 8% interest to £6,171.43. Therefore, to lock in your return, you need to sell forward £6,171.43 at the forward exchange rate.

11. The relationship between the spot and forward exchange rates indicates that the U.S. dollar is expected to appreciate against the Euro. Therefore, the interest rate in the U.S. is higher, in order to induce investors to invest in the U.S.

12.

   a. Using the relationship:
   $$F_0 = E_0 \times \frac{1 + r_f(US)}{1 + r_f(UK)} = 1.50 \times \frac{1.04}{1.03} = 1.515$$

   b. If the forward rate is 1.53 dollars per pound, then the forward rate is overpriced. To create an arbitrage profit, use the following strategy:

Action	Initial Cash Flov	Cash Flow at Time T
Enter a contract to sell £1.03 at a (futures price) of $F_0 = \$1.53$	0.0	$1.03 \times (1.53 - E_1)$
Borrow $1.50 in the U.S.	1.50	-1.50×1.04
Convert the borrowed dollars to pounds, and lend in the U.K. at a 3% interest rate	-1.50	$1.03 \times E_1$
Total	0	0.0159

13.

   a. Lend in the U.K.

   b. Borrow in the U.S.

   c. According to the interest rate parity relationship, the forward rate should be:
   $$F_0 = E_0 \times \frac{1 + r_f(US)}{1 + r_f(UK)} = 2.00 \times \frac{1.05}{1.07} = 1.9626$$

   The strategy will involve:

Action	Initial Cash Flov	Cash Flow at Time T

Enter a contract to sell £1.07 at a (futures price) of $F_0 = \$1.97$	0.0	$1.07 \times (1.97 - E_1)$
Borrow $2.00 in the U.S.	2.00	-2.00×1.05
Convert the borrowed dollars to pounds, and lend in the U.K. at a 7% interest rate	-2.00	$1.07 \times E_1$
Total	0	0.0079

14. See results below

The table below includes all cells of the U.S. index and seven international portfolios from Table 19.9B.
In the following cells, actual performance is replaced by forecasts:
1. Average return on the U.S. portfolio was replaced by a forecast of the U.S. risk premium of 0.5% per month.
2. Alpha values of the seven portfolios were replaced by arbitrary forecast as shown in the column "Alpha."
3. Average return of the seven portfolios were recalculated with the new alpha values.
4. The Information and Sharpe ratios were recalculated with the forecasts.

Market	Monghly Excess Return		Regression on U.S. returns				Performance	
	Av. Return	SD	Correlation	Beta	Alpha	Resid SD	Info ratio	Sharpe
USA	0.50	4.81	1	1	0	0	0	0.10
Large-market portfolio	0.40	4.71	0.79	0.77	0.0100	2.90	0.0035	0.08
EU-dev portfolio	0.55	6.08	0.84	1.06	0.0220	3.33	0.0066	0.09
Aust+FE portfolio	0.54	6.21	0.80	1.04	0.0250	3.68	0.0068	0.09
Europe-dev portfolio	0.43	4.95	0.79	0.82	0.0260	3.01	0.0086	0.09
EM-FE-SA portfolio	0.54	7.10	0.69	1.01	0.0330	5.17	0.0064	0.08
EM- LA portfolio	0.71	7.83	0.78	1.27	0.0700	4.90	0.0143	0.09
EM-Europe portfolio	0.77	9.54	0.70	1.38	0.0750	6.84	0.0110	0.08

Optimization follows the index-model (Treynor-Black) procedure.

	alpha/residual variance	weights in active pf		
Large-market portfolio	0.00119	0.08742	Active pf alpha	0.03969
EU-dev portfolio	0.00198	0.14530	Active pf residual variance	2.91188
Aust+FE portfolio	0.00184	0.13511	Active pf info ratio	0.02326
Europe-dev portfolio	0.00286	0.21010	Active pf beta	1.05958
EM-FE-SA portfolio	0.00123	0.09059	w(0)	0.62981
EM- LA portfolio	0.00291	0.21376	w*	0.65436 Optimal position in active pf
EM-Europe portfolio	0.00160	0.11772	Optimal position in U.S.	0.34564
sum	0.01363	1.00000	Optimal position in pfs	

Large-market port	0.05721
EU-dev portfolio	0.09508
Aust+FE portfolio	0.08841
Europe-dev portfolio	0.13748
EM-FE-SA portfolio	0.05928
EM- LA portfolio	0.13988
EM-Europe portfolio	0.07703
sum	0.65436

Optimal pf Sharpe   0.10660

CFA 1

   d. We exchange $1 million for foreign currency at the current exchange rate and sell forward the amount of foreign currency we will accumulate 90 days from now. For the yen investment, we initially receive:

1 million × 133.05 = ¥133.05 million

Invest for 90 days to accumulate:

¥133.05 × [1 + (0.076/4)] = ¥135.57795 million

(We divide the quoted 90-day rate by 4, since quoted money market interest rates typically are annualized using simple interest and assuming a 360-day year.)

If we sell this number of yen forward at the forward exchange rate of ¥133.47/dollar, we will end up with:

$$\frac{135.57795 \text{ million}}{133.47} = \$1.015793 \text{ million}$$

The 90-day dollar interest rate is 1.5793%.

Similarly, the dollar proceeds from the 90-day Swiss franc investment will be:

$$[\$1 \text{ million} \times 1.526] \times \frac{1 + (.086/4)}{1.5348} = \$1.015643 \text{ million}$$

The 90-day dollar interest rate is 1.5643%, almost the same as that in the yen investment.

   b. The nearly identical results in either currency are expected and reflect the interest-rate parity relationship. This example thus asserts that the pricing relationships between interest rates and spot and forward exchange rates must make covered investments in any currency equally attractive.

   c. The dollar-hedged rate of return on default-free government securities in Japan is 1.5793% and in Switzerland is 1.5643%. Therefore, the 90-day interest rate available on U.S. government securities must be between 1.5643% and 1.5793%. This corresponds to an annual rate between 6.2572% and 6.3172%, which is less than the APR in Japan or Switzerland. (For consistency with our earlier calculations, we annualize the 90-day rate using the convention of the money market, assuming a 360-day year and simple interest). The lower interest rate in the U.S. makes sense, as the relationship between forward and spot exchange rates indicates that the U.S. dollar is expected to appreciate against both the Japanese yen and the Swiss franc.

CFA 2

a. The primary rationale is the opportunity for diversification. Factors that contribute to low correlations of stock returns across national boundaries are:

   i. imperfect correlation of business cycles
   ii.   imperfect correlation of interest rates
   iii.   imperfect correlation of inflation rates
   iv.   exchange rate volatility

b. Obstacles to international investing are:

   i.   Availability of information, including insufficient data on which to base investment decisions. It is difficult to interpret and evaluate data that is different in form and/or content than the routinely available and widely understood U.S. data. Also, much foreign data is reported with a considerable lag.
   ii.   Liquidity, in terms of the ability to buy or sell, in size and in a timely manner, without affecting the market price. Most foreign exchanges offer (relative to U.S. norms) limited trading, and experience greater price volatility. Moreover, only a (relatively) small number of individual foreign stocks enjoy liquidity comparable to that in the U.S., although this situation is improving steadily.
   iii.   Transaction costs, particularly when viewed as a combination of commission plus spread plus market impact costs, are well above U.S. levels in most foreign markets. This, of course, adversely affects return realization.
   iv.   Political risk.
   v.   Foreign currency risk, although to a great extent, this can be hedged.

c. The asset-class performance data for this particular period reveal that non-U.S. dollar bonds provided a small incremental return advantage over U.S. dollar bonds, but at a considerably higher level of risk. Each category of fixed income assets outperformed the S&P 500 Index measure of U.S. equity results with regard to both risk and return, which is certainly an unexpected outcome. Within the equity area, non-U.S. stocks, represented by the EAFE Index, outperformed U.S. stocks by a considerable margin with only slightly more risk. In contrast to U.S. equities, this asset category performed as it should relative to fixed income assets, providing more return for the higher risk involved.

   Concerning the Account Performance Index, its position on the graph reveals an aggregate outcome that is superior to the sum of its component parts. To some extent, this is due to the beneficial effect on performance resulting from multi-market diversification and the differential covariances involved. In this case, the portfolio manager(s) (apparently) achieved an on-balance positive alpha, adding to total portfolio return by their actions. The addition of international (i.e., non-U.S.) securities to a portfolio that would otherwise have held only domestic (U.S.) securities clearly worked to the advantage of this fund over this time period.

CFA 3

The return on the Canadian bond is equal to the sum of:

coupon income +

gain or loss from the premium or discount in the forward rate relative to the spot exchange rate +

capital gain or loss on the bond.

Over the six-month period, the return is:

Coupon + forward premium/discount + capital gain =

$$\frac{7.50\%}{2} + (-0.075\%) + \text{Price change in }\% = 3.00\% + \% \text{ capital gain}$$

The expected semiannual return on the U.S. bond is 3.25%. Since the U.S. bond is selling at par and its yield is expected to remain unchanged, there is no expected capital gain or loss on the U.S. bond. Therefore, in order to provide the same return, the Canadian bond must provide a capital gain of 0.25% (i.e., 1/4 point relative to par value of 100) over and above any expected capital gain on the U.S. bond.

CFA 4

a. The following arguments could be made in favor of active management:

Economic diversity: the diversity of the Otunian economy across various sectors may offer the opportunity for the active investor to employ "top down" sector timing strategies.

High transaction costs: very high transaction costs may discourage trading activity by international investors and lead to inefficiencies that may be exploited successfully by active investors.

Good financial disclosure and detailed accounting standards: good financial disclosure and detailed accounting standards may provide the well-trained analyst an opportunity to perform fundamental research analysis in order to identify inefficiently priced securities.

Capital restrictions: restrictions on capital flows may discourage foreign investor participation and serve to segment the Otunian market, thus creating exploitable market inefficiencies for the active investor.

Developing economy and securities market: developing economies and markets are often characterized by inefficiently priced securities and by rapid economic change and growth. The active investor may exploit these characteristics.

Settlement problems: long delays in settling trades by non-residents may serve to discourage international investors, leading to inefficiently priced securities which may be exploited by active management.

The following arguments could be made in favor of indexing:

Economic diversity: economic diversity across a broad sector of industries implies that indexing may provide a diverse representative portfolio that is not subject to the risks associated with concentrated sectors.

High transaction costs: indexing would be favored by the implied lower levels of trading activity and costs.

Settlement problems: indexing would be favored by the implied lower levels of trading activity and settlement requirements.

Financial disclosure and accounting standards: wide public availability of reliable financial information presumably leads to greater market efficiency, reducing the value of both fundamental analysis and active management and favoring indexing.

Restrictions of capital flows: indexing would be favored by the implied lower levels of trading activity and thus smaller opportunity for regulatory interference.

b. A recommendation for active management would focus on short-term inefficiencies in, and long term prospects for, the developing Otunian markets and economy, inefficiencies and prospects which would not generally be found in more developed markets.

A recommendation for indexing would focus on the factors of economic diversity, high transaction costs, settlement delays, capital flow restrictions, and lower management fees.