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*Part B*

**END-OF-CHAPTER**

**SOLUTIONS**

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## Chapter 1

### A Brief History of Risk and Return

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#### Answers to Questions and Problems

##### Core Questions

1. No, whether you choose to sell the stock or not does not affect the gain or loss for the year; your stock is worth what it would bring if you sold it. Whether you choose to do so or not is irrelevant (ignoring taxes).
2. Capital gains yield =  $(\$31 - \$42)/\$42 = -26.19\%$   
Dividend yield =  $\$2.40/\$42 = +5.71\%$   
Total rate of return =  $-26.19\% + 5.71\% = -20.48\%$
3. Dollar return =  $750(\$60 - \$42) + 750(\$2.40) = \$15,300$   
Capital gains yield =  $(\$60 - \$42)/\$42 = 42.86\%$   
Dividend yield =  $\$2.40/\$42 = 5.71\%$   
Total rate of return =  $42.86\% + 5.71\% = 48.57\%$
4.
  - a. average return = 5.41%, average risk premium = 1.31%
  - b. average return = 4.10%, average risk premium = 0%
  - c. average return = 12.83%, average risk premium = 8.73%
  - d. average return = 17.21%, average risk premium = 13.11%
5. Jurassic average return = 11.4%; Stonehenge average return = 9.4%
6. A: average return = 6.20%, variance = 0.00627, standard deviation = 7.92%  
B: average return = 9.40%, variance = 0.03413, standard deviation = 18.47%
7. For both risk and return, increasing order is *b, c, a, d*. On average, the higher the risk of an investment, the higher is its expected return.
8. That's plus or minus one standard deviation, so about two-thirds of time or two years out of three.
9. You lose money if you have a negative return. With a 6 percent expected return and a 3 percent standard deviation, a zero return is two standard deviations below the average. The odds of being outside (above or below) two standard deviations are 5 percent; the odds of being below are half that, or 2.5 percent. You should expect to lose money only 2.5 years out of every 100. It's a pretty safe investment.

10.  $\text{Prob}(\text{Return} < -2.94 \text{ or } \text{Return} > 13.76) \approx 1/3$ , but we are only interested in one tail;  
 $\text{Prob}(\text{Return} < -2.94) \approx 1/6$ .  
 95%:  $5.41 \pm 2\sigma = 5.41 \pm 2(8.35) = -11.29\% \text{ to } 22.11\%$   
 99%:  $5.41 \pm 3\sigma = 5.41 \pm 3(8.35) = -19.64\% \text{ to } 30.46\%$

### Intermediate Questions

11. Expected return = 17.21% ;  $\sigma = 34.34\%$ . Doubling your money is a 100% return, so if the return distribution is normal, “z” =  $(100 - 17.21)/34.31 = 2.41$  standard deviations; this is in between two and three standard deviations, so the probability is small, somewhere between .5% and 2.5% (why?). (Referring to the nearest “z” table, the actual probability is  $\approx 1\%$ , or once every 100 years.) Tripling your money would be “z” =  $(200 - 17.21)/34.31 = 5.32$  standard deviations; this corresponds to a probability of (much) less than 0.5%, or once every 200 years. (The actual answer is less than once every 1 million years; don’t hold your breath.)
12. It is impossible to lose more than –100 percent of your investment. Therefore, return distributions are cut off on the lower tail at –100 percent; if returns were truly normally distributed, you could lose much more.

13.

<u>Year</u>	<u>Common stocks</u>	<u>T-bill return</u>	<u>Risk premium</u>
1980	32.6%	12.0%	20.6%
1981	–5.0	15.2	–20.2
1982	21.7	11.3	10.4
1983	22.6	8.9	13.7
1984	6.2	10.0	– 3.8
1985	31.9	7.7	24.2
1986	<u>18.7</u>	<u>6.2</u>	<u>12.5</u>
	128.7	71.3	57.4

- a. Annual risk premium = Common stock return – T-bill return (see table above).
- b. Average returns: Common stocks =  $128.7 / 7 = 18.4\%$  ; T-bills =  $71.3 / 7 = 10.2\%$ , Risk premium =  $57.4 / 7 = 8.2\%$
- c. Common stocks:  $\text{Var} = 1/6[ (.326-.184)^2 + (-.05-.184)^2 + (.217-.184)^2 + (.226-.184)^2 + (.062-.184)^2 + (.319-.184)^2 + (.187-.184)^2 ]$   
 $= 0.01848$   
 Standard deviation =  $(0.01848)^{1/2} = 0.1359 = 13.59\%$
- T-bills:  $\text{Var} = 1/6[ (.120-.102)^2 + (.152-.102)^2 + (.113-.102)^2 + (.089-.102)^2 + (.100-.102)^2 + (.077-.102)^2 + (.062-.102)^2 ]$   
 $= 0.00089$   
 Standard deviation =  $(0.00089)^{1/2} = 0.02984 = 2.98\%$

Risk premium: 
$$\text{Var} = 1/6 [ (.206 - .082)^2 + (-.202 - .082)^2 + (.104 - .082)^2 + (.137 - .082)^2 + (-.038 - .082)^2 + (.242 - .082)^2 + (.125 - .082)^2 ] = 0.02356$$

$$\text{Standard deviation} = (0.02356)^{1/2} = 0.1535 = 15.35\%$$

- d.* Before the fact, the risk premium will be positive; investors demand compensation over and above the risk-free return to invest their money in the risky asset. After the fact, the observed risk premium can be negative if the asset's nominal return is unexpectedly low, the risk-free return is unexpectedly high, or any combination of these two events.
14. T-bill rates were highest in the early eighties; inflation at the time was relatively high. As we discuss in our chapter on interest rates, rates on T-bills will almost always be slightly higher than the rate of inflation.
  15. Risk premiums are about the same whether or not we account for inflation. The reason is that risk premiums are the difference between two returns, so inflation essentially nets out.
  16. Returns, risk premiums, and volatility would all be lower than we estimated because aftertax returns are smaller than pretax returns.
  17. We've seen that T-bills barely kept up with inflation before taxes. After taxes, investors in T-bills actually lost ground (assuming anything other than a very low tax rate). Thus, an all T-bill strategy will probably lose money in real dollars for a taxable investor.
  18. It's important not to lose sight of the fact that the results we have discussed cover well over 70 years, well beyond the investing lifetime for most of us. There have been extended periods during which small stocks have done terribly. Thus, one reason most investors will chose not to pursue a 100 percent stock strategy is that many investors have relatively short horizons, and high volatility investments may be very inappropriate in such cases. There are other reasons, but we will defer discussion of these to later chapters.

## Chapter 2

### Buying and Selling Securities

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#### Answers to Questions and Problems

##### Core questions

1. Purchasing on margin means borrowing some of the money used. You do it because you desire a larger position than you can afford to pay for, recognizing that using margin is a form of financial leverage. As such, your gains and losses will be magnified. Of course, you hope it is the gains you experience.
2. Shorting a security means borrowing it and selling it, with the understanding that at some future date you will buy the security and return it, thereby “covering” the short. You do it because you believe the security’s value will decline, so you hope to sell high, then buy low.
3. Margin requirements amount to security deposits. They exist to protect your broker against losses.
4. Asset allocation means choosing among broad categories such as stocks and bonds. Security selection means picking individual assets within a particular category such as shares of stock in particular companies.
5. They can be. Market timing amounts to active asset allocation, moving money in and out of certain broad classes (such as stocks) in anticipation of future market direction. Of course, market timing and passive asset allocation are not the same.
6. Some benefits from street name registration include:
  - a. The broker holds the security, so there is no danger of theft or other loss of the security. This is important because a stolen or lost security cannot be easily or cheaply replaced.
  - b. Any dividends or interest payments are automatically credited, and they are often credited more quickly (and conveniently) than they would be if you received the check in the mail.
  - c. The broker provides regular account statements showing the value of securities held in the account and any payments received. Also, for tax purposes, the broker will provide all the needed information on a single form at the end of the year, greatly reducing your record-keeping requirements.

- d. Street name registration will probably be required for anything other than a straight cash purchase, so, with a margin purchase for example, it will likely be required.
7. Probably none. The advice you receive is unconditionally *not* guaranteed. If the recommendation was grossly unsuitable or improper, then arbitration is probably your only possible means of recovery. Of course, you can close your account, or at least what's left of it.
8. If you buy (go long) 300 shares at \$18, you have a total of \$5,400 invested. This is the most you can lose because the worst that could happen is that the company could go bankrupt, leaving you with worthless shares. There is no limit to what you can make because there is no maximum value for your shares—they can increase in value without limit.
9. Maximum margin = 50%.  $\$15,000 / \$75$  per share = 200 shares.
10. The worst that can happen to a share of stock is for the firm to go bankrupt and the stock to become worthless, so the maximum gain to the short position is \$30,000. However, since the stock price can rise without limit, the maximum loss to a short stock position is unlimited.

#### Intermediate questions

11.

<u>Assets</u>		<u>Liabilities and account equity</u>	
200 shares of Mobil	\$15,000	Margin loan	\$7,500
		Account equity	<u>7,500</u>
Total	<u>\$15,000</u>	Total	<u>\$15,000</u>

Stock price = \$90

<u>Assets</u>		<u>Liabilities and account equity</u>	
200 shares of Mobil	\$18,000	Margin loan	\$7,500
		Account equity	<u>10,500</u>
Total	<u>\$18,000</u>	Total	<u>\$18,000</u>

Margin =  $\$10,500 / \$18,000 = 58.3\%$

Stock price = \$65

<u>Assets</u>		<u>Liabilities and account equity</u>	
200 shares of Mobil	\$13,000	Margin loan	\$7,500
		Account equity	<u>5,500</u>
Total	<u>\$13,000</u>	Total	<u>\$13,000</u>

$$\text{Margin} = \$5,500/\$13,000 = 42.3\%$$

12.  $600 \text{ shares} \times \$50 \text{ per share} = \$30,000$ ; initial margin =  $\$20,000/\$30,000 = 66.7\%$

<u>Assets</u>		<u>Liabilities and account equity</u>	
600 shares of Apple	\$30,000	Margin loan	\$10,000
		Account equity	<u>\$20,000</u>
Total	<u>\$30,000</u>	Total	<u>\$30,000</u>

13. Interest on loan =  $\$10,000(1 + .0725)^{1/2} - \$10,000 = \$356.16$   
 Dividends received =  $600(\$0.75) = \$450$   
 Proceeds from stock sale =  $600(\$55) = \$33,000$   
 Dollar return =  $\$33,000 - \$30,000 - \$356.16 + \$450 = \$3,093.84$   
 Rate of return =  $\$3,093.84/\$20,000 = 15.47\%/\text{six months}$ ;  $(1.1547)^2 - 1 = 33.3\%/\text{year}$

14.  $\$24,000/\$80 = 300 \text{ shares}$ ; initial margin =  $300/500 = 60\%$   
 Margin loan =  $200(\$80) = \$16,000$   
 $(500P - \$16,000)/500P = .30$ ;  $P = \$45.71$   
 To meet a margin call, you can deposit additional cash into your trading account, liquidate shares until your margin requirement is met, or deposit marketable securities against your account as collateral.

15. Interest on loan =  $\$16,000(1.065) - \$16,000 = \$1,040$
- Proceeds from sale =  $500(\$100) = \$50,000$   
 Dollar return =  $\$50,000 - \$40,000 - \$1,040 = \$8,960$   
 Rate of return =  $\$8,960/\$24,000 = 37.3\%$   
 Without margin, rate of return =  $(\$100 - \$80)/\$80 = 25\%$
  - Proceeds from sale =  $500(\$80) = \$40,000$   
 Dollar return =  $\$40,000 - \$40,000 - \$1,040 = -\$1,040$   
 Rate of return =  $-\$1,040/\$24,000 = -4.3\%$   
 Without margin, rate of return =  $0\%$
  - Proceeds from sale =  $500(\$60) = \$30,000$   
 Dollar return =  $\$30,000 - \$40,000 - \$1,040 = -\$11,040$   
 Rate of return =  $-\$11,040/\$24,000 = -46.0\%$   
 Without margin, rate of return =  $(\$60 - \$80)/\$80 = -25\%$

16.	Assets		Liabilities and account equity	
	Proceeds from sale	\$100,000	Short position	\$100,000
	Initial margin deposit	<u>100,000</u>	Account equity	<u>100,000</u>
	Total	<u>\$200,000</u>	Total	<u>\$200,000</u>

17.	<u>Assets</u>		<u>Liabilities and account equity</u>	
	Proceeds from sale	\$100,000	Short position	\$100,000
	Initial margin deposit	<u>75,000</u>	Account equity	<u>75,000</u>
	Total	<u>\$175,000</u>	Total	<u>\$175,000</u>

18. Proceeds from short sale =  $1,000(\$70) = \$70,000$   
 Cost of covering short =  $1,000(\$50) = \$50,000$   
 Cost of covering dividends =  $1,000(\$1) = \$1,000$   
 Dollar profit =  $\$70,000 - \$50,000 - \$1,000 = \$19,000$   
 Rate of return =  $\$19,000/\$70,000 = 27.1\%$

19. Proceeds from short sale =  $5,000(\$25) = \$125,000$   
 Margin deposit =  $.60(\$125,000) = \$75,000$   
 Total liabilities plus account equity =  $\$125,000 + \$75,000 = \$200,000$   
 $(\$200,000 - 5,000P)/5,000P = .4$  ;  $P = \$28.57$

20. If the asset is illiquid, it may be difficult to quickly sell it during market declines, or to purchase it during market rallies. Hence, special care should always be given to investment positions in illiquid assets, especially in times of market turmoil.



## Chapter 3

### Security Types

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#### Answers to Questions and Problems

##### Core Questions

1. The two distinguishing characteristics are: (1) all money market instruments are debt instruments (i.e., IOUs), and (2) all have less than 12 months to maturity when originally issued.
2. Preferred stockholders have a dividend preference and a liquidation preference. The dividend preference requires that preferred stockholders be paid before common stockholders. The liquidation preference means that, in the event of liquidation, the preferred stockholders will receive a fixed face value per share before the common stockholders receive anything.
3. The PE ratio is the price per share divided by annual earnings per share (EPS). EPS is the sum of the most recent four quarters' earnings.
4. The current yield on a bond is very similar in concept to the dividend yield on common and preferred stock.
5. Dividend yield =  $.046 = \$3.60/P_0$  ;  $P_0 = 3.60/.046 = \$78.26 \approx 78 \frac{1}{4}$   
 Stock closed down  $\frac{3}{8}$ , so yesterday's closing price =  $78 \frac{1}{4} + \frac{3}{8} = 78 \frac{5}{8}$   
 7,295 round lots of stock were traded.
6.  $PE = 16$ ;  $EPS = P_0 / 16 = \$4.89 = NI/shares$  ;  $NI = \$4.89(5,000,000) = \$24.45M$
7. Dividend yield is 4.6%, so annualized dividend is  $.046(\$67) = \$3.082$ . This is just four times the last quarterly dividend, which is thus  $\$.3082/4 = \$.7705/share$ .
8. Volume in stocks is quoted in round lots (multiples of 100). Volume in corporate bonds is the actual number of bonds. Volume in options is reported in contracts; each contract represents the right to buy or sell 100 shares. Volume in futures contracts is reported in contracts, where each contract represents a fixed amount of the underlying asset.
9. You make or lose money on a futures contract when the *futures* price changes, not the current price for immediate delivery (although the two may be related).
10. Open interest is the number of outstanding contracts. Since most contracts will be closed, it will usually shrink as maturity approaches.

Intermediate Questions

11. Preferred A: dividend yield =  $\$1.20/\$11.625 = 10.3\%$   
 Preferred B: dividend yield =  $\$3.00/\$32 = 9.4\%$  ; A has the higher dividend yield.  
 B was more actively traded than A, 8,500 shares compared to A's 5,900.  
 Preferred A: maximum dividend yield =  $\$1.20/\$10.5 = 11.4\%$   
 Preferred B: maximum dividend yield =  $\$3.00/\$30.5 = 9.8\%$   
 A has traded at the highest dividend yield over the past 52 weeks.
12. Current yield =  $.087 = \$78.75/P_0$ ;  $P_0 = \$78.75/.087 = \$905.17 = 90.52\%$  of par  $\approx 90 \frac{1}{2}$ .  
 Bond closed up  $\frac{1}{2}$ , so yesterday's closing price = 90.
13. The bond matures in the year 2011. Next payment =  $25(.07875/2)(\$1,000) = \$984.38$ .
14. Open interest in the March 1996 contract is 18,752 contracts.  
 Since the standard contract size is 50,000 lbs., sell  $400,000/50,000 = 8$  contracts.  
 You'll deliver  $8(50,000) = 400,000$  pounds of cotton and receive  $8(50,000)(\$0.84) = \$336,000$ .
15. Trading volume yesterday in all open contracts was approximately 19,000.  
 The day before yesterday, 11,313 contracts were traded.
16. Initial value of position =  $15(50,000)(\$0.8522) = \$639,150$   
 Final value of position =  $15(50,000)(\$0.8955) = \$671,625$   
 Dollar profit =  $\$671,625 - \$639,150 = \$32,475$
17. Shares of GNR stock sell for  $39 \frac{7}{8}$ . The right to sell shares is a put option on the stock; the December put with a strike price of  $\$40$  closed at  $3 \frac{3}{8}$ . Since each stock option contract is on 100 shares of stock, you're looking at  $1,500/100 = 15$  option contracts. Thus, the cost of purchasing this right is  $15(3.375)(100) = \$5,062.50$
18. The cheapest put contract (that traded on this particular day) is the September 35 put. The most expensive option is the December 50 put. The first option is cheap because it has little time left to maturity, yet is out-of-the-money. The latter option is expensive because it has a relatively long time to maturity and is currently deep-in-the-money.
19. Case 1: Payoff =  $\$40 - \$32 = \$8/\text{share}$ . Dollar return =  $\$8(15)(100) - \$5,062.50 = \$6,937.50$   
 Return on investment per 3 months =  $\$6,937.50/\$5,062.50 = 137.04\%$   
 Annualized return on investment =  $(1+1.3704)^4 - 1 = 3,157\%$   
 Case 2: The option finishes out-of-the-money, so payoff =  $\$0$ . Dollar return =  $-\$5,062.50$   
 Return on investment =  $-100\%$  over all time periods.

- 20.** The very first call option listed has a strike price of 10 and a quoted premium of  $5\frac{7}{8}$ . This can't be right because you could buy a option for  $\$5\frac{7}{8}$  and immediately exercise it for another \$10. You can then sell the stock for its current price of about \$20, earning a large, riskless profit. To prevent this kind of easy money, the option premium must be at least \$10.

## Chapter 4

### Mutual Funds

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#### Answers to Questions and Problems

##### Core Questions

1. Mutual funds are owned by fund shareholders. A fund is run by the fund manager, who is hired by the fund's directors. The fund's directors are elected by the shareholders.
2. A rational investor might pay a load because he or she desires a particular type of fund or fund manager for which a no-load alternative does not exist. More generally, some investors feel you get what you pay for and are willing to pay more. Whether they are correct or not is a matter of some debate. Other investors simply are not aware of the full range of alternatives.
3. The NAV of a money market mutual fund is never *supposed* to change; it is supposed to stay at a constant \$1. It never rises; only in very rare instances does it fall. Maintaining a constant NAV is possible by simply increasing the number of shares as needed such that the number of shares is always equal to the total dollar value of the fund.
4. A money market deposit account is essentially a bank savings account. A money market mutual fund is a true mutual fund. A bank deposit is insured by the FDIC, so it is safer, at least up to the maximum insured amount.
5.  $NAV = \$2.5B / 75M = \$33.33$
6. Since the price quoted is higher than NAV, this is a load fund.  
 $Load = (\$36.03 - \$33.33) / \$36.03 = 7.5\%$
7.  $NAV = \$56(1 - .025) = \$54.60$  ; Market value of assets =  $\$54.60(12.5M) = \$682.5M$
8. A capital appreciation fund seeks maximum possible growth without regard to income; an equity income fund is concerned with generating dividend income first, with growth a secondary goal. Generally speaking, a capital appreciation fund would be substantially riskier because maximum possible growth usually involves investments in newer, less well-established companies in less well-established industries.
9. Initial shares = 25,000. Final shares =  $25,000(1.069) = 26,725$ , and final NAV = \$1 because this is a money market fund.

10. You should probably buy an open end fund because the fund stands ready to buy back shares at NAV; with a closed-end fund, another buyer must make the purchase, so it may be more difficult to sell at NAV. We should note that an open end fund may have the right to delay redemption if it so chooses.
11. The fund's NAV is \$10.25; yesterday's NAV was \$0.10 lower, \$10.15. If you buy 100 shares, you pay \$1,025 because this is a no-load fund.
12. The +3.5 tells us that the fund is up 3.5% year-to-date.

### Intermediate

13.  $\text{Turnover} = X/\$1.2\text{B} = .45$  ;  $X = \$540\text{M}$ . This is less than the \$650M is sales, so this is the number used in the calculation of turnover in this case.
14. Management fee =  $.0085(\$1.2\text{B}) = \$10.2\text{M}$   
Miscellaneous and administrative expenses =  $(.0125 - .0085)\$1.2\text{B} = \$4.8\text{M}$
15. Initial NAV =  $\$18.75(1 - .06) = \$17.625$   
Final NAV =  $\$17.625[1 + (.18 - .0135)] = \$20.56$   
Sale proceeds per share =  $\$20.56(1 - .03) = \$19.94$   
Total return =  $(\$19.94 - \$18.75)/\$18.75 = 6.4\%$   
  
You earned 6.4% even though the fund's investments grew by 18%! The various fees and loads sharply reduced your return.
16. Initial NAV = \$18.75 ; Final NAV =  $\$18.75[1 + (.18 - .0085)] = \$21.97$  = Sale proceeds  
Total return =  $(\$21.97 - \$18.75)/\$18.75 = 17.15\%$
17. Municipal fund: aftertax yield =  $.048(1 - .08) = 4.42\%$   
Taxable fund: aftertax yield =  $.075(1 - .35 - .08) = 4.28\%$   
New Jersey municipal fund: aftertax yield = 4.5% ; choose the New Jersey fund.
18. Municipal fund: aftertax yield = 4.8%  
Taxable fund: aftertax yield =  $.075(1 - .35) = 4.88\%$   
New Jersey municipal fund: aftertax yield = 4.5% ; choose the taxable fund.
19.  $(\$8.75 - \text{NAV})/\text{NAV} = -.125$  ; NAV = \$10  
Shares outstanding =  $\$275\text{M}/\$10 = 27.5\text{M}$   
For closed-end funds, the total shares outstanding are fixed, just as with a common stock (assuming no net repurchases by the fund or new share issues to the public).

- 20.** NAV at IPO =  $\$10(1 - .09) = \$9.10$   
 $(P - \$9.10)/\$9.10 = -.10$  ;  $P = \$8.19$

The value of your investment is  $5,000(\$8.19) = \$40,950$ , a loss of \$9,050 in one day.

## Chapter 5

### The Stock Market

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#### Answers to Questions and Problems

##### Core Questions

1. The new car lot is a primary market; every new car sold is an IPO. The used car lot is a secondary market. The Chevy retailer is a dealer, buying and selling out of inventory.
2. Both. When trading occurs in the crowd, the specialist acts as a broker. When necessary to fulfill an order, the specialist will buy or sell out of inventory.
3. A stop order converts to a market order if the stop price is reached. Thus, the advantage of a stop order is that it will be executed if the prespecified price is reached. However, the actual price an investor pays or gets may be better or worse than the stop price. With a limit order, there is the risk that the order cannot be executed, but, if it is, the price will be the limit price or better. The tradeoff is between certainty of execution with a stop versus a potentially better price with a limit order.
4. A stop-loss order is an order to sell at market if the price declines to the stop price. As the name suggests, it is a tool to limit losses. As with any stop order, however, the price received may be worse than the stop price, so it may not work as well as the investor hopes. For example, suppose a stock is selling for \$50. An investor has a stop loss on at \$45, thereby limiting the potential loss to \$5, or so the naive investor thinks. However, after the market closes, the company announces a disaster. Next morning, the stock opens at \$30. The investor's sell order will be executed, but the loss suffered will far exceed \$5 per share.
5. You should submit a stop order; more specifically, a start-gain order with a stop price of \$120.
6. No, you should submit a stop order to buy at \$70, also called a start-gain. A limit buy would be executed immediately at the current price (why?).
7. A stop limit order is a stop order that converts to a limit order once the stop price is reached. Two prices must be specified, the stop and the limit. You might use it to, for example, buy a stock but control what you pay. You could submit a buy order as "stop \$100 limit \$110." This means if the price hits \$100, you want to buy it, but only at a price of \$110 or better (i.e., \$110 or less).

8. The uptick rule prohibits short selling unless the last stock price change was positive, i.e., an uptick. Until recently, it applied primary to the NYSE, but the Nasdaq now has a similar rule. It exists to prevent “bear raids,” i.e., an illegal market manipulation involving large-scale short selling intended to force down the stock price.
9. With a multiple market maker system, there are, in general, multiple bid and ask prices. The inside quotes are the best ones, the highest bid and the lowest ask.
10. What market is covered; what types of stocks are included; how many stocks are included; and how the index is calculated.
11. The issue is index staleness. As more stocks are added, we generally start moving into less frequently traded issues. Thus, the tradeoff is between comprehensiveness and currentness.

### Intermediate Questions

12. The average share price at the beginning of the year is  $(\$30 + \$80)/2 = \$55$ . At the end of the year, the average price is \$89.5. Thus, the average price increased by \$34.5 from \$55, a percentage gain of  $\$34.5/\$55 = 62.73\%$ . Total market cap at the beginning of the year is  $\$30 \times 200 \text{ million} + \$80 \times 50 = \$10 \text{ billion}$ . It rises to \$14.8 billion, a gain of \$4.8 billion. The percentage gain is thus 48%.
13. If no adjustment were made, the index would fall whenever there was a split even though nothing real has actually happened in the market. Another, and much simpler, way to adjust would be to increase the number of shares in the index. In other words, following a 3-for-1 split, we just put 3 shares (representing an additional 2 shares) in the index, thereby effectively “unsplitting” the stock.
14.
  - a.  $1/1/98$ : Index value  $= (60 + 20 + 40)/3 = 40$
  - b.  $1/1/99$ : Index value  $= (75 + 25 + 35)/3 = 45$   
 $1998 \text{ return} = (45 - 40)/40 = 12.5\%$   
 $1/1/00$ : Index value  $= (60 + 40 + 35)/3 = 45$   
 $1999 \text{ return} = (45 - 45)/45 = 0\%$
  - c. Total two-year index return  $= (45 - 40)/40 = 12.5\%$



- 15.** Share price after the stock split is \$15.  
 Index value on 1/1/99 without the split is 45 (see above).  
 $(15 + 25 + 35)/d = 45$  ;  $d = 75/45 = 1.667$ .  
 1/1/00: Index value =  $(12 + 40 + 35)/1.667 = 52.2$ .  
 1999 return =  $(52.2 - 45)/45 = 16\%$ .  
 Notice without the split the index return for 1999 is 0%.  
 Total two-year index return =  $(52.2 - 40)/40 = 30.5\%$ .
- 16.** a. 1/1/98: Index value =  $[ 60(150) + 20(750) + 40(300) ] / 10 = 3600$   
 b. 1/1/99: Index value =  $[ 75(150) + 25(750) + 35(300) ] / 10 = 4050$   
 1998 return =  $(4050 - 3600)/3600 = 12.5\%$   
 1/1/00: Index value =  $[ 60(150) + 40(750) + 35(300) ] / 10 = 4950$   
 1999 return =  $(4950 - 4050)/4050 = 22.2\%$   
 c. Total two-year index return =  $(4950 - 3600)/3600 = 37.5\%$
- 17.** The index values and returns will be unchanged; the stock split changes the share price, but not the total value of the firm.
- 18.** 1998: Douglas McDonnell return =  $(75 - 60)/60 = 25\%$   
 Dynamics General return =  $(25 - 20)/20 = 25\%$   
 International Rockwell return =  $(35 - 40)/40 = -12.5\%$   
 1998: Index return =  $(.25 + .25 - .125)/3 = 12.5\%$   
 1/1/99: Index value =  $100(1.125) = 112.5$   
 1998: Douglas McDonnell return =  $(60 - 75)/75 = -20\%$   
 Dynamics General return =  $(40 - 25)/25 = 60\%$   
 International Rockwell return =  $(35 - 35)/35 = 0\%$   
 1999: Index return =  $(-.20 + .60 + 0)/3 = 13.33\%$   
 1/1/00: Index value =  $112.5(1.1333) = 127.50$   
 Total two-year index return =  $(127.50 - 100)/100 = 27.5\%$

- 19.** For price-weighted indices, purchase equal numbers of shares for each firm in the index. For value-weighted indices, purchase shares (perhaps in fractional amounts) so that the investment in each stock, relative to your total portfolio value, is equal to that stock's proportional market value relative to all firms in the index. In other words, if one company is twice as big as the other, put twice as much money in that company. Finally, for equally-weighted indices, purchase equal dollar amounts of each stock in the index.

Assuming no cash dividends or stock splits, both the price-weighted and value-weighted replication strategies require no additional rebalancing. However, an equally weighted index will not stay equally weighted through time, so it will have to be rebalanced by selling off investments that have gone up in value and buying investments that have gone down in value.

A typical small investor would most likely use something like the equally weighted index replication strategy, i.e., buying more-or-less equal dollar amounts of a basket of stocks, but the portfolio probably would not stay equally weighted. The value-weighted and equally-weighted index replication strategies are more difficult to implement than the price-weighted strategy because they would likely involve the purchase of odd lots and fractional shares, raising transactions costs. The value-weighted strategy is the most difficult because of the extra computation needed to determine the initial amounts to invest.

## Chapter 6

### Common Stock Valuation

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#### Answers to Questions and Problems

##### Core Questions

1. The basic principle is that we can value a share of stock by computing the present value of all future dividends.
2. P/E ratios measure the price of a share of stock relative to current earnings. All else the same, future earnings will be larger for a growth stock than a value stock, so investors will pay more relative to today's earnings.
3. The earnings yield is earnings per share divided by price per share, i.e., the reciprocal of the P/E ratio.
4. It is computed by taking net income plus depreciation and then dividing by the number of shares outstanding.
5.  $V(0) = \$3.50/(1.09)^1 + \$3.50/(1.09)^2 + \$3.50/(1.09)^3 + \$40/(1.09)^3 = \$39.75$
6.  $V(0) = \$3.50/(1.09)^1 + \$3.50/(1.09)^2 + \$3.50/(1.09)^3 + \$LD/(1.09)^3 = \$50$

With a little calculation, we get that the liquidating dividend (LD) must be \$53.28.

7.  $V(0) = [\$2(1.05)/(.10 - .05)][1 - (1.05/1.10)^5] = \$8.72$   
 $V(0) = [\$2(1.05)/(.10 - .05)][1 - (1.05/1.10)^{10}] = \$15.62$   
 $V(0) = [\$2(1.05)/(.10 - .05)][1 - (1.05/1.10)^{30}] = \$31.60$   
 $V(0) = [\$2(1.05)/(.10 - .05)][1 - (1.05/1.10)^{100}] = \$41.60$
8.  $V(0) = \$25 = [D(1.08)/(.15 - .08)][1 - (1.08/1.15)^{10}]$  ;  $D = \$3.47$
9.  $V(0) = [\$3.75(1.20)/(.12 - .20)][1 - (1.20/1.12)^{20}] = \$167.31$   
 $V(0) = (20)\$3.75 = \$75.00$   
 $V(0) = [\$3.75(1.06)/(.12 - .06)][1 - (1.06/1.12)^{20}] = \$44.22$   
 $V(0) = [\$3.75(1.00)/(.12 - 0)][1 - (1.00/1.12)^{20}] = \$28.01$   
 $V(0) = [\$3.75(0.95)/(.12 + .05)][1 - (0.95/1.12)^{20}] = \$20.18$
10.  $V(0) = \$70 = \$4/(k - .04)$  ,  $k = .04 + 4/70 = 9.71\%$

11.  $V(0) = \$25 = [\$1.25(1+g)]/(.15-g)$  ;  $g = 9.524\%$
12.  $V(0) = \$85 = D(1)/(.08 - .05)$  ;  $D(1) = \$2.55$   
 $D(3) = \$2.55(1.05)^2 = \$2.81$
13. Retention ratio =  $1 - (\$5/\$12.50) = .60$   
 Sustainable growth rate =  $.20(.60) = 12\%$
14. Sustainable growth =  $.05 = .20r$  ; retention ratio =  $.25$   
 Payout ratio =  $1 - .25 = .75 = D/Ni = \$3/Ni$  ;  $Ni = 3/.75 = \$4 = EPS$   
 $P/E = 15$ ,  $EPS = \$4$ , so  $V(0) = 4(15) = \$60$

### Intermediate Questions

15.  $V(5) = \$3(1.12)/(.15-.12) = \$112$   
 $V(0) = \$112/(1.15)^5 = \$55.68$
16.  $D(3) = D(0)(1.3)^3$  ;  $D(4) = D(0)(1.3)^3(1.2)$   
 $V(4) = D(4)(1+g)/(k-g) = D(0)(1.3)^3(1.2)(1.06)/(.15-.06) = 31.05D(0)$   
 $V(0) = \$42.50 = D(0)\{ (1.3/1.15) + (1.3/1.15)^2 + (1.3/1.15)^3 + [1.3^3(1.2) + 31.05]/1.15^4 \}$   
 $D(0) = 42.50/23.11 = 1.84$  ;  $D(1) = 1.84(1.3) = \$2.39$
17.  $V(4) = \$1.00(1.08)/(.16-.08) = \$13.50$   
 $V(0) = \$2.25/1.16 + \$4.00/1.16^2 + \$3.00/1.16^3 + \$14.50/1.16^4 = \$14.84$
18.  $V(6) = D(7)/(k-g) = \$2.50(1.065)^7/ (.10-.065) = \$111$   
 $V(3) = \$2.50(1.065)^4/1.15 + \$2.50(1.065)^5/1.15^2 + \$2.50(1.065)^6/1.15^3 + \$111/1.15^3 =$   
 $\$80.77$   
 $V(0) = \$2.50(1.065)/1.2 + \$2.50(1.065)^2/1.2^2 + \$2.50(1.065)^3/1.2^3 + \$80.77/1.2^3 =$   
 $\$52.68$
19. P/E ratio: values are 14, 15.56, 13.91, 13.97, 13.91, 13.33 ; average = 14.11  
 Average EPS 5-year growth rate = 13.98%  
 Expected share price =  $14.11(3.75)(1.1398) = \$60.31$   
 P/CFPS: values are 3.50, 4.00, 3.88, 4.40, 4.36, 4.39 ; average = 4.09  
 Average CFPS 5-year growth rate = 7.70%  
 Expected share price =  $4.09(11.40)(1.077) = \$50.22$   
 P/S: values are .560, .603, .582, .611, .600, .581 ; average = .590  
 Average sales 5-year growth rate = 12.07%  
 Expected share price =  $.590(86)(1.1207) = \$56.86$

A reasonable price range would seem to be \$50 to \$60 per share.

- 20.**  $k = .05 + 1.1(.085) = 14.35\%$   
Historical average dividend growth rate = 10.15%  
 $V(0) = \$1.20(1.1015)/(.1435 - .1015) = \$31.47$

## Chapter 7

### Earnings and Cash Flow Analysis

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#### Answers to Questions and Problems

##### Core Questions

1. The 10K and 10Q are reports public firms must file with the SEC. They contain, among other things, financial statements including balance sheets, income statements, and cash flow statements. The easiest way to retrieve them is on-line from EDGAR.
2. A balance sheet is a summary, at a point in time, of what a firm owns and owes. An income statement reports revenues and costs that accrue over some period in time.
3. They are current in the sense that they are expected to convert to cash (or otherwise be used up) within the next 12 months. Operating assets are current because they simply consist of current assets other than cash.
4. Earnings per share are equal to net income divided by the number of shares outstanding. Net income is sometimes called “total earnings.” There are some issues concerning how to measure shares outstanding, but these go beyond the scope of this chapter.
5. Depreciation is a “noncash item” because the depreciation deduction does not literally represent a cash outflow. It is instead purely an accounting entry.
6. Operating cash flow; investment cash flow, and financing cash flow.
7. It is the cash generated by ordinary business activity, meaning the everyday, routine functioning of the business.
8. A pro forma financial statement is essentially a hypothetical financial statement, meaning that it is a financial statement that is based on specific sets of assumptions and/or events that have not occurred (and may not ever occur). The term “pro forma” literally means “according to a prescribed form,” but a better translation in this context is “hypothetical.”
9. The retained earnings number on the income statement is amount retained that year. The number on the balance sheet is the cumulative amount from all previous years. Put differently, the income statement number is the increment or addition to the balance sheet number.

10. Gross margin is gross profit divided by sales, where gross profit is sales less cost of goods sold. Operating margin is operating profit divided by sales, where operating profit is equal to gross profit less operating expenses. Thus, the difference is that operating margin considers both costs of goods sold and operating expenses. They indicate how much of each sales dollar is left after accounting for costs of goods sold (gross margin) and, additionally, for operating expenses (operating margin). Generally speaking, larger values are better.
11. Gross margin will be larger (why?). Both can be negative. Also, gross margin can be positive while operating margin is negative, but not the other way around (why?).
12. No, but dividend paying companies certainly wish they were! Dividends received from another company are taxed preferentially. Depending on the circumstances, only 20 percent or 30 percent are subject to taxes; the rest is not taxed.

### Intermediate Questions

13. The bottom line on the cash flow statement is operating cash flow, less money spent on fixed assets and other investments, less the net amount paid or raised due to financial transactions (i.e., things like borrowing money, paying dividends, or paying interest). It actually measures the change in the amount of cash the firm has available from one period to the next.
14. It's conventionally computed as *operating* cash flow divided by the number of shares outstanding.
15. The literal interpretation is that it is the sum of all the yearly retained earnings numbers. There are two important things to recognize. First, in any given year, the retained earnings number on the income statement is simply what's left over after dividends are subtracted from net income. Dividends are paid in cash, but net income is not a cash flow (because, for example, it includes noncash deductions). As a result, the retained earnings are not cash flows either. The actual cash flow that is "retained" is some very different number. Second, to the extent that Coors does "retain" cash, that cash doesn't just sit there. Instead, it is used to do things like purchase assets and pay off debts. Cash or earnings aren't so much "retained" as they are "reinvested." Thus, the retained earnings number isn't cash, and even if it were, it wouldn't just be a pile of cash sitting around somewhere.
16. Gross margin is  $\$820/\$2,480 = 33.1\%$ . Operating margin is  $\$220/\$2,480 = 8.9\%$ .
17. Return on assets (ROA) is  $\$144/\$1,240 = 11.6\%$ . Return on equity (ROE) is  $\$144/\$720 = 20\%$ .

18. Note that, measured in thousands, there are 120 shares. Book value per share (BVPS) is thus  $\$720/120 = \$6$ . Earnings per share (EPS) is  $\$144/120 = \$1.20$  (as shown on the income statement). Cash flow per share (CFPS) is  $\$234/120 = \$1.95$ . The recent price per share is \$24, so the price/book ratio is 4; the price/earnings ratio is 20; and the price/cash flow ratio is 12.31.
19. With 10% sales growth, sales will rise to \$2,728 from \$2,480. The pro forma income statement follows. A constant gross margin is assumed, implying that cost of goods sold will also rise by 10%. A constant tax rate of 40% is used. Items in italics are carried over unchanged.

***Dixie Chickens pro forma 2001 Income Statement***

Net sales	\$2,728
Cost of goods sold	<u>(1,826)</u>
Gross profit	\$ 902
<i>Operating expenses</i>	<u>(600)</u>
Operating income	\$ 302
<i>Other income</i>	90
<i>Net interest expense</i>	<u>(70)</u>
Pretax income	\$ 322
Income tax	<u>129</u>
Net income	<u>\$ 193</u>
Earnings per share	\$ 1.61
Shares outstanding	120,000
Recent price	\$n/a

Next, we prepare the cash flow statement. Notice that we pick up the \$193 net income from the pro forma income statement. Items in italics are carried over unchanged. By assumption, no investments occur, and no long-term debt is issued or redeemed.



***Dixie Chickens pro forma 2001 Cash Flow Statement***

Net income	\$193
<i>Depreciation and amortization</i>	100
<i>Changes in operating assets</i>	(50)
<i>Changes in current liabilities</i>	<u>40</u>
Operating cash flow	\$283
Net additions to properties	\$ 0
Changes in other assets	<u>0</u>
Investing cash flow	\$ 0
Issuance/redemption of long-term debt	\$ 0
<i>Dividends paid</i>	<u>(72)</u>
Financing cash flow	\$(72)
Net cash increase	<u>\$211</u>

Finally, we have the balance sheet. Cash rises by the \$211 net cash increase from the cash flow statement. The \$50 increases in operating assets and the \$40 increase in current liabilities are also from the cash flow statement. The \$100 reduction in property, plant, and equipment is the amount of the depreciation deduction shown on the cash flow statement. The increase in retained earnings is equal to pro forma net income less pro forma dividends.

***Dixie Chickens pro forma 2001 Balance Sheet***

Cash and cash equivalents	\$ 311
Operating assets	350
Property, plant, and equipment	700
<i>Other assets</i>	<u>40</u>
Total assets	<u>\$1,401</u>
Current liabilities	\$ 140
<i>Long-term debt</i>	400
<i>Other liabilities</i>	<u>20</u>
Total liabilities	\$ 560
<i>Paid-in capital</i>	\$ 30
Retained earnings	<u>811</u>
Total shareholder equity	\$ 841
Total liabilities and equity	<u>\$1,401</u>

- 20.** Using the benchmark from question 18, projected stock prices are:

$$\text{BVPS} \times \text{P/B} = (\$841/120) \times 4 = \$28.03$$

$$\text{EPS} \times \text{P/E} = \$1.61 \times 20 = \$32.20$$

$$\text{CFPS} \times \text{P/CF} = (\$283/120) \times 12.31 = \$29.03$$

Thus, projected prices assuming a 10% sales increase are in the \$28 - \$32 range.

## Chapter 8

### Stock Price Behavior and Market Efficiency

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#### Answers to Questions and Problems

##### Core Questions

1. There are three trends at all times, the primary, secondary, and tertiary trends. For a market timer, the secondary, or short-run trend, might be the most important, but, for most investors, it is the primary, or long-run trend that matters.
2. A support area is a price or level below which a stock price or market index is not likely to drop. A resistance area is a price or level above which a stock price or market index is not likely to rise.
3. A correction is movement toward the long-run trend. A confirmation is a signal that the long-run trend has changed direction.
4. The fact that the market is up is good news, but market breadth (the difference between the number of gainers and losers) is negative. To a technical analyst, a market advance on narrow or negative breadth is not a particularly positive event.
5. The Arms (or trin) is a ratio. The numerator has the average number of shares traded in stocks that were down for the day; the denominator has the average number of shares traded that were up for the day. It indicates whether trading is heavier in down or up issues.

6.		Monday	Tuesday	Wednesday	Thursday	Friday
	Adv – Dec	845	720	–1,465	–745	600
	Cumulative	845	1,565	100	–645	–45

The market closed the week on a modestly bullish signal according to this technical indicator.

7.		Monday	Tuesday	Wednesday	Thursday	Friday
	Avg Dec Vol	78.571	115.000	130.864	89.231	110.526
	Avg Adv Vol	133.531	95.349	105.357	113.636	119.355
	Arms Ratio	0.588	1.206	1.242	0.785	0.926

The market closed the week on an essentially neutral signal according to this technical indicator.

8. For initial investments of equal value, will need to purchase 1.6 shares of Pepsi for every share of Coke. Suppose you buy 5 shares of Coke and 8 shares of Pepsi.

Month	Coke	Pepsi	Relative Strength
1	\$200	\$200	1.000
2	225	224	1.004
3	240	256	0.938
4	220	264	0.833
5	245	280	0.875
6	275	288	0.955

Coke stock underperformed relative to Pepsi over this period, although both stocks increased in value. Note that no adjustment for the risk of either firm is included, however.

9. The moving averages must be calculated relative to the share price; also note that results can't be computed for the first two months because of insufficient data.

Month	Coke	Coke Mov Avg	Pepsi	Pepsi Mov Avg
1	\$40	—	\$25	—
2	45	—	28	—
3	48	\$44.33	32	\$28.33
4	44	45.67	33	31.00
5	49	47.00	35	33.33
6	55	49.33	36	34.67

Notice how the moving average has smoothed out Coke's performance over the period.

10. Institutional investors play two roles. First, they tend to sell losers and buy winners in the fourth quarter so that their end-of-year portfolio holdings look like a winning group ("window dressing"). Second, in search of better performance, they have a tendency to buy smaller stocks immediately after the turn of the year. If the smaller stocks do well, the pros may have an incentive to sell them off and move into the benchmark portfolio to lock in the gain ("bonus lock-in"). Also, if the smaller stocks do poorly, there may be an incentive to bail out and move into the benchmark to prevent even greater damage.

### Intermediate Questions

11. The index was up on the day, so the body would be white. It would be  $439.50 - 431.30 = 8.20$  points in length, the difference between the open and closing price. The upper shadow or wick would extend  $447.20 - 439.50 = 7.70$  points above the top of the body, reflecting trading at much higher levels during the day. The lower shadow or wick would extend  $431.30 - 430.00 = 1.30$  points below the bottom of the body, reflecting that the market was generally up throughout the day.

12. If the market is efficient, then market timing is a bad idea. Trying to time the market will only mean that over a long period, the investor will underperform a strategy that stays fully invested. A timing strategy will incur significant costs and, likely, taxes as well.
13. The first column is a down column; there are 7 columns in all with 14 ticks. The number of ticks in each of the columns are 4, 1, 2, 2, 1, 3, and 1, respectively. The figure indicates a strong down trend at the outset, and a modest up trend towards the end. The stock basically meanders in the middle period.
14. A point-and-figure chart does not have time on the horizontal axis. It may be that by only focusing on larger moves and by abstracting from calendar time, a point-and-figure chart can better isolate market patterns and directions.
15. The market is not weak-form efficient.
16. Unlike gambling, the stock market is a positive sum game; everybody can win. Also, speculators provide liquidity to markets and thus help to promote efficiency.
17. The efficient markets paradigm only says, within the bounds of increasingly strong assumptions about the information processing of investors, that assets are fairly priced. An implication of this is that, on average, the typical market participant cannot earn excess profits from a particular trading strategy. However, that does not mean that a few particular investors cannot outperform the market over a particular investment horizon. Certain investors who do well for a period of time get a lot of attention from the financial press, but the scores of investors who do not do well over the same period of time generally get considerably less attention.
18.
  - a. If the market is not weak-form efficient, then this information could be acted on and a profit earned from following the price trend. Under 2, 3, and 4, this information is fully impounded in the current price and no abnormal profit opportunity exists.
  - b. Under 2, if the market is not semistrong form efficient, then this information could be used to buy the stock “cheap” before the rest of the market discovers the financial statement anomaly. Since 2 is stronger than 1, both imply a profit opportunity exists; under 3 and 4, this information is fully impounded in the current price and no profit opportunity exists.
  - c. Under 3, if the market is not strong form efficient, then this information could be used as a profitable trading strategy, by noting the buying activity of the insiders as a signal that the stock is underpriced or that good news is imminent. Since 1 and 2 are weaker than 3, all three imply a profit opportunity. Under 4, the information doesn’t signal a profit opportunity for traders; pertinent information the manager-insiders may have is fully reflected in the current share price.

- d.* Despite the fact that this information is obviously less open to the public and a clearer signal of imminent price gains than is the scenario in part (c), the conclusions remain the same. If the market is strong form efficient, a profit opportunity does not exist. A scenario such as this one is the most obvious evidence against strong-form market efficiency; the fact that such insider trading is also illegal should convince you of this fact.
- 19.** At the time the theory was developed, large companies in the U.S. were either involved in the manufacturing of goods or the transportation of them (primarily railroads). The basic idea behind the Dow theory is that these activities are fundamentally related, so the two averages must move in the same direction over time.
- 20.** Taken at face value, this fact suggests that markets have become more efficient. The increasing ease with which information is available over the internet lends strength to this conclusion. On the other hand, during this particular period, large cap growth stocks were the top performers. Value-weighted indexes such as the S&P 500 are naturally concentrated in such stocks, thus making them especially hard to beat during this period. So, it may be that the dismal record compiled by the pros is just a matter of bad luck.

## Chapter 9

### Interest Rates

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#### Answers to Questions and Problems

##### Core Questions

1. Short-term rates have ranged between zero and 14 percent. Long-term rates have fluctuated between about two and 13 percent. Long-term rates, which are less volatile, have historically been in the four-five percent range (the 1960 - 1990 experience is the most notable exception). Short-term rates have about the same typical values, but more volatility (and lower rates in the unusual 1930 - 1960 period).
2. A pure discount security is a financial instrument that promise a single fixed payment (the face value) in the future with no other payments in between. Such a security sells at a discount relative to its face value, hence the name. Treasury bills and commercial paper are two examples.
3. The Fed funds rate is set in a very active market by banks borrowing and lending from each other. The discount rate is set by Fed at whatever the Fed feels is appropriate. The Fed funds rate changes all the time; the discount rate only changes when the Fed decides; the Fed funds rate is therefore much more volatile. The Fed funds market is much more active. Banks usually borrow from the Fed only as a last resort, which is the primary reason for the Fed's discount rate-based lending.
4. Both are pure discount money market instruments. T-bills, of course, are issued by the government; commercial paper is issued by corporations. The primary difference is that commercial paper has default risk, so it offers a higher interest rate.
5. LIBOR is the London Interbank Offered Rate. It is the interest rate offered by major London banks for dollar-denominated deposits. Interest rates on loans are often quoted on a LIBOR-plus basis, so the LIBOR is an important, fundamental rate in business lending, among other things.
6. A zero-coupon bond *is* a pure discount security. Beyond this, the distinguishing feature of a "zero" is usually understood to have maturity greater than one year when originally issued (otherwise it would be a money market instrument).
7. Such rates are much easier to compute by hand; they predate (by hundreds of years or more) computing machinery.

8. They are coupon interest, note principal, and bond principal. Recalling that each STRIPS represents a particular piece of a Treasury note or bond, these designations tell us which piece is which. A *ci* is one of the many coupon payments on a note or bond, an *np* is the final principal payment on a Treasury note, a *bp* is the final principal payment on a Treasury bond.
9. We observe nominal rates almost exclusively. Which one is more relevant actually depends on the investor and, more particularly, what the proceeds from the investment will be used for. If the proceeds are needed to make payments that are fixed in nominal terms (like a loan repayment, perhaps), then nominal rates are more important. If the proceeds are needed to purchase real goods (like groceries) and services, then real rates are more important.
10. Trick question! It depends. Municipals have a significant tax advantage, but they also have default risk. Low risk municipals usually have lower rates; higher risk municipals can (and often do) have higher ones.

#### Intermediate Questions

11.  $d = .055 = [(\$1M - P)/\$1M](360/89)$  ;  $P = \$986,403$
12.  $y = [365(.055)]/[360 - (89)(.055)] = 5.653\%$
13.  $1.061 = [1 + (APR)(120/365)]^{365/120}$  ;  $APR = \text{bond equivalent yield} = 5.979\%$   
 $\text{discount yield} = [360(.05979)]/[365 + (120)(.05979)] = 5.783\%$
14. Recall that the prices are given as a percentage of par value, and the units after the colon are 32nds of 1 percent by convention.

Feb97 STRIP: 95.3125	$= 100/[1+(y/2)]^2$ ;	$y = 4.859\%$
Feb98 STRIP: 90.15625	$= 100/[1+(y/2)]^4$ ;	$y = 5.249\%$
Feb99 STRIP: 84.90625	$= 100/[1+(y/2)]^6$ ;	$y = 5.529\%$
Feb00 STRIP: 79.09375	$= 100/[1+(y/2)]^8$ ;	$y = 5.950\%$
Feb01 STRIP: 74.21875	$= 100/[1+(y/2)]^{10}$ ;	$y = 6.053\%$
Feb02 STRIP: 69.50	$= 100/[1+(y/2)]^{12}$ ;	$y = 6.157\%$

Note that the term structure is upward sloping; the expectations hypothesis then implies that this reflects market expectations of rising interest rates in the future.

15.  $EAR = [1 + (.05249/2)]^2 - 1 = 5.318\%$



$$16. \quad [1 + (.05249/2)]^4 = [1 + (.04859/2)]^2(1+f_{1,1}) ; f_{1,1} = 5.719\%$$

$$f_{1,1} = 100/[1.05719] = 94.590\% \text{ of par} = 94:19 \text{ rounded to the nearest 32nd.}$$

Note that this price can be found directly from the relationship  $f_{T,K} = 100P_{T+K}/P_T$  where the first subscript refers to the time when the forward rate/price begins, the second subscript refers to the length of the forward rate/price, and  $P$  represents current or spot prices of various maturities. Similarly,  $f_{T,K} = (P_T/P_{T+K}) - 1$ . Thus

$$f_{1,1} = 100(90.15625/95.3125) = 94.590 ; f_{1,1} = (95.3125/90.15625) - 1 = 5.719\%$$

The implied 1-year forward rate is larger than the current 1-year spot rate, reflecting the expectation that interest rates will go up in the future. Hence, for upward-sloping term structures, the implied forward rate curve lies above the spot rate curve.

$$17. \quad f_{1,5} = 100(69.50/95.3125) = 72.918\% \text{ of par} = 72:29 \text{ rounded to the nearest 32nd.}$$

$$72.918 = 100/(1+f_{1,5})^5 ; f_{1,5} = 6.521\%$$

$$f_{3,2} = 100(74.21875/84.90625) = 87.413\% \text{ of par} = 87:13 \text{ rounded to the nearest 32nd.}$$

$$87.413 = 100/(1+f_{3,2})^2 ; f_{3,2} = 6.958\%$$

$$18. \quad [1 + (.05249/2)]^4 = [1 + (.04859/2)]^2(1+f_{1,1}) + .0030 ; f_{1,1} = 5.433\%$$

$$f_{1,1} = 100/(1.05433) = 94.847\% \text{ of par} = 94:27 \text{ rounded to the nearest 32nd.}$$

Intuitively, the maturity premium on 2-year investments makes the future 1-year STRIP more valuable; hence the forward price is greater and the forward rate lower.

Alternatively, verify that if the forward rate and 1-year spot rate stayed the same as before, the spot 2-year price would become 89.913% of par and the corresponding yield would be 5.388%; i.e., the longer maturity investment would be less valuable.

19. Feb01 STRIPS:  $P^* = 100/[1 + (.04859 + .0025) / 2]^2 = 95.080\%$  of par  
 $?% = (95.080 - 95.3125)/95.3125 = -0.244\%$
- Feb03 STRIPS:  $P^* = 100/[1 + (.05529 + .0025) / 2]^6 = 84.290\%$  of par  
 $?% = (84.290 - 84.90625)/84.90625 = -0.726\%$
- Feb06 STRIPS:  $P^* = 100/[1 + (.06157 + .0025) / 2]^{12} = 68.496\%$  of par  
 $?% = (68.496 - 69.5)/69.5 = -1.445\%$

For equal changes in yield, the longer the maturity, the greater the percentage price change. Hence, for parallel yield curve shifts, the price volatility is greater for longer-term instruments.

- Feb01 STRIPS:  $95.3125 - .50 = 100/[1 + (y^*/2)]^2$ ;  $y^* = 5.398\%$   
 $? = 5.398 - 4.859 = +0.539\%$ ;  $?% = .539/4.859 = 11.09\%$
- Feb03 STRIPS:  $84.90625 - .50 = 100/[1 + (y^*/2)]^6$ ;  $y^* = 5.732\%$   
 $? = 5.732 - 5.529 = +0.203\%$ ;  $?% = .203/5.529 = 3.66\%$
- Feb06 STRIPS:  $69.50 - .50 = 100/[1 + (y^*/2)]^{12}$ ;  $y^* = 6.281\%$   
 $? = 6.281 - 6.157 = +0.124\%$ ;  $?% = .124/6.157 = 2.01\%$

For equal changes in price, the absolute yield volatility is greater the shorter the maturity; the effect is magnified for percentage yield volatility when the yield curve is upward sloping, because yields (the divisor) are smaller for short maturities. Because of this, note that for sharply downward sloping yield curves, it's possible for shorter maturity instruments to have less percentage yield volatility, but greater absolute yield volatility, than slightly longer maturity instruments.

20. Real rate =  $.05 - .035 = 1.5\%$ . Real interest rates are not observable because they do not correspond to any traded asset (at least not until very recently in the U.S.); hence, they must be inferred from nominal interest rates (which do correspond to traded assets), and from estimated inflation data. Real interest rate estimates are therefore only as good as (1) the inflation estimates used in the Fisher relation, and (2) the degree to which the Fisher relation itself actually describes the behavior of economic agents.

## Chapter 10

### Bond Prices and Yields

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#### Answers to Questions and Problems

##### Core Questions

1. Premium (par, discount) bonds are bonds that sell for more (the same as, less) than their face or par value.
2. The face value is normally \$1,000 per bond. The coupon is expressed as a percentage of face value (the coupon rate), so the annual dollar coupon is calculated by multiplying the coupon rate by \$1,000. Coupons are paid semi-annually; the semi-annual coupon is equal to the annual coupon divided by two.
3. The coupon rate is the annual dollar coupon expressed as percentage of face value. The current yield is the annual dollar coupon divided by the current price. If a bond's price rises, the coupon rate won't change, but the current yield will fall.
4. Interest rate risk refers to the fact that bond prices fluctuate as interest rates change. Lower coupon and longer maturity bonds have greater interest rate risk.
5. For a premium bond, the coupon rate is higher than the yield. The reason is simply that the bonds sells at a premium *because* it offers a coupon rate that is high relative to current market required yields. The reverse is true for a discount bond: it sells at a discount because its coupon rate is too low.
6. A bond's promised yield is an indicator of what an investor can *expect* to earn if (1) all of the bond's promised payments are made, and (2) market conditions do not change. The realized yield is the actual, after-the-fact return the investor receives. The realized yield is more relevant, of course, but it is not knowable ahead of time. A bond's calculated yield to maturity is the promised yield.
7. The yield to maturity is the required rate of return on a bond expressed as a nominal annual interest rate. For noncallable bonds, the yield to maturity and required rate of return are interchangeable terms. Unlike YTM and required return, the coupon rate is not a return used as the interest rate in bond cash flow valuation, but is a fixed percentage of par over the life of the bond used to set the coupon payment amount. For the example given, the coupon rate on the bond is still 10 percent, and the YTM is 8 percent.

8. Price and yield move in opposite directions; if interest rates rise, the price of the bond will fall. This is because the fixed coupon payments determined by the fixed coupon rate are not as valuable when interest rates rise—hence, the price of the bond decreases.
9.  $P = \$35(PVIFA_{4.25\%,22}) + \$1000(PVIF_{4.25\%,22}) = \$894.16$
10.  $P = \$1,225 = \$51.25(PVIFA_{r\%,28}) + \$1000(PVIF_{r\%,28})$ ;  $r = 3.805\%$ ,  $YTM = 7.61\%$ .  
current yield =  $\$102.50/\$1,225 = 8.37\%$

### Intermediate Questions

11.  $P = \$860 = \$C(PVIFA_{5\%,21}) + \$1000(PVIF_{5\%,21})$ ;  $C = \$39.08$ , coupon rate =  $2(3.908) = 7.82\%$
12.  $P = \$43.75(PVIFA_{7.25\%/2,18}) + \$1000(PVIF_{7.25\%/2,18}) = \$1,097.91$
13.  $P = \$960 = \$47.50(PVIFA_{r\%,20}) + \$1000(PVIF_{r\%,20})$ ;  $r = 5.073\%$ ;  $YTM = 10.15\%$
14.
  - a. Bond price is the present value of the future cash flows from a bond; YTM is the interest rate used to discount these cash flows.
  - b. If the coupon rate is higher than the required return on a bond, the bond will sell at a premium, since it provides periodic income in the form of coupon payments in excess of that required by investors on other similar bonds. If the coupon rate is lower than the required return on a bond, the bond will sell at a discount, since it provides insufficient coupon payments compared to that required by investors on other similar bonds. For premium bonds, the coupon rate exceeds the YTM; for discount bonds, the YTM exceeds the coupon rate, and for bonds selling at par, the YTM is equal to the coupon rate.
  - c. Current yield is defined as the annual coupon payment divided by the current bond price. For premium bonds, the current yield exceeds the YTM, for discount bonds the current yield is less than the YTM, and for bonds selling at par value, the current yield is equal to the YTM. In all cases, the current yield plus the expected one-period capital gains yield of the bond must be equal to the required return.

15. A premium bond is one with a relatively high coupon, and, in particular, a coupon that is higher than current market yields. These are precisely the bonds that the issuer would like to call (and replace with a lower-coupon bond), so a yield to call is probably a better indicator of what is likely to happen than the yield to maturity (the opposite is true for discount bonds). It is also the case that the yield to call is likely to be lower than the yield to maturity for a premium bond, but this can depend on the call price. A better convention would be to report the yield to maturity or yield to call, whichever is smaller.

16. X:  $P_0 = \$45(\text{PVIFA}_{3.5\%,30}) + \$1000(\text{PVIF}_{3.5\%,30}) = \$1,183.92$   
 $P_1 = \$45(\text{PVIFA}_{3.5\%,28}) + \$1000(\text{PVIF}_{3.5\%,28}) = \$1,176.67$   
 $P_5 = \$45(\text{PVIFA}_{3.5\%,20}) + \$1000(\text{PVIF}_{3.5\%,20}) = \$1,142.12$   
 $P_{10} = \$45(\text{PVIFA}_{3.5\%,10}) + \$1000(\text{PVIF}_{3.5\%,10}) = \$1,083.17$   
 $P_{14} = \$45(\text{PVIFA}_{3.5\%,2}) + \$1000(\text{PVIF}_{3.5\%,2}) = \$1,019.00$   
 $P_{15} = \$1,000$

Y:  $P_0 = \$30(\text{PVIFA}_{4.5\%,30}) + \$1000(\text{PVIF}_{4.5\%,30}) = \$755.67$   
 $P_1 = \$30(\text{PVIFA}_{4.5\%,28}) + \$1000(\text{PVIF}_{4.5\%,28}) = \$763.86$   
 $P_5 = \$30(\text{PVIFA}_{4.5\%,20}) + \$1000(\text{PVIF}_{4.5\%,20}) = \$804.88$   
 $P_{10} = \$30(\text{PVIFA}_{4.5\%,10}) + \$1000(\text{PVIF}_{4.5\%,10}) = \$881.31$   
 $P_{14} = \$30(\text{PVIFA}_{4.5\%,2}) + \$1000(\text{PVIF}_{4.5\%,2}) = \$971.91$   
 $P_{15} = \$1,000$

All else held equal, the premium over par value for a premium bond declines as maturity is approached, and the discount from par value for a discount bond declines as maturity is approached. This pricing pattern is sometimes called the “pull to par.”

17. If both bonds sell at par, the initial YTM on both bonds is the coupon rate, 8 percent. If the YTM suddenly rises to 10 percent:

$$P_A = \$40(\text{PVIFA}_{5\%,4}) + \$1000(\text{PVIF}_{5\%,4}) = \$964.54$$

$$P_B = \$40(\text{PVIFA}_{5\%,30}) + \$1000(\text{PVIF}_{5\%,30}) = \$846.28$$

$$P_A\% = (964.54 - 1000)/1000 = -3.55\%$$

$$P_B\% = (846.28 - 1000)/1000 = -15.37\%$$

If the YTM suddenly falls to 6 percent:

$$P_A = \$40(\text{PVIFA}_{3\%,4}) + \$1000(\text{PVIF}_{3\%,4}) = \$1,037.17$$

$$P_B = \$40(\text{PVIFA}_{3\%,30}) + \$1000(\text{PVIF}_{3\%,30}) = \$1,196.00$$

$$P_A\% = (1,037.17 - 1000)/1000 = +3.72\%$$

$$P_B\% = (1,196.00 - 1000)/1000 = +19.60\%$$

All else the same, the longer the maturity of a bond, the greater is its price sensitivity to changes in interest rates.

- 18.** Initially, at a YTM of 9 percent, the prices of the two bonds are:

$$PJ = \$20(PVIFA_{4.5\%,20}) + \$1000(PVIF_{4.5\%,20}) = \$674.80$$

$$PK = \$50(PVIFA_{4.5\%,20}) + \$1000(PVIF_{4.5\%,20}) = \$1,065.04$$

If the YTM rises from 9 percent to 11 percent:

$$PJ = \$20(PVIFA_{5.5\%,20}) + \$1000(PVIF_{5.5\%,20}) = \$581.74$$

$$PK = \$50(PVIFA_{5.5\%,20}) + \$1000(PVIF_{5.5\%,20}) = \$940.25$$

$$PJ\% = (581.74 - 674.80)/674.80 = -13.79\%$$

$$PK\% = (940.25 - 1,065.04)/1,065.04 = -11.72\%$$

If the YTM declines from 9 percent to 7 percent:

$$PJ = \$20(PVIFA_{3.5\%,20}) + \$1000(PVIF_{3.5\%,20}) = \$786.81$$

$$PK = \$50(PVIFA_{3.5\%,20}) + \$1000(PVIF_{3.5\%,20}) = \$1,213.19$$

$$PJ\% = (786.81 - 674.80)/674.80 = +16.60\%$$

$$PK\% = (1,213.19 - 1,065.04)/1,065.04 = +13.91\%$$

All else the same, the lower the coupon rate on a bond, the greater is its price sensitivity to changes in interest rates.

- 19.** Current yield = .0901 =  $\$100/P_0$  ;  $P_0 = \$100/.0901 = \$1,109.88$   
 $P_0 = \$1,109.88 = \$50[(1 - (1/1.0425)^N) / .0425] + \$1,000/1.0425^N$   
 $1,109.88(1.0425)^N = 1,176.47(1.0425)^N - 1,176.47 + 1,000$   
 $176.47 = 66.59(1.0425)^N$ ;  $2.65 = 1.0425^N$  ;  $N = \log 2.65 / \log 1.0425 = 23.415 = 11.71$   
 years
- 20.** The maturity is indeterminate; a bond selling at par can have any maturity length.
- 21.** a.  $P_0 = \$1,100 = \$50(PVIFA_{r\%,20}) + \$1000(PVIF_{r\%,20})$  ;  $r = 4.248\%$ ,  
 YTM = 8.50%

This is the rate of return you expect to earn on your investment when you purchase the bond.

$$\begin{aligned}
 b. \quad P_2 &= \$50(PVIFA_{3\%,16}) + \$1000(PVIF_{3\%,16}) = \$1,251.22 \\
 P_0 &= \$1,100 = \$50(PVIFA_{r\%,4}) + \$1,251.22(PVIF_{r\%,4}) ; r = 7.614\%, \\
 &\text{yield} = 15.23\%
 \end{aligned}$$

The realized yield is greater than the expected yield when the bond was bought because interest rates have dropped by 2.5 percent; bond prices rise when yields fall.

- 22.** The yield to call can be computed as:

$$P = \$1,200 = \$45(PVIFA_{r\%,10}) + \$1,100(PVIF_{r\%,10}) ; r = 3.024\%, YTC = 6.05\%$$

Since the bond sells at a premium to par value, you know the coupon rate must be greater than the yield. Thus, if interest rates remain at current levels, the bond issuer will likely call the bonds to refinance (at lower coupon rates) at the earliest possible time, which is the date when call protection ends. The yield computed to this date is the YTC, and it will always be less than the YTM for premium bonds with a zero call premium. In the present example,

$$P = \$1,200 = \$45(PVIFA_{r\%,24}) + \$1,000(PVIF_{r\%,24}) ; r = 3.283\%, YTM = 6.57\%$$

where if the bond is held until maturity, no call premium must be paid. Note that using the same analysis, a break-even call premium can also be computed:

$$P = \$1,200 = \$45(PVIFA_{3.283\%,10}) + (\$1,000 + X)(PVIF_{3.283\%,10}) ; X = \$134.91$$

Thus, if interest rates remain unchanged, the bond will not be called if the call premium is greater than \$134.91.

- 23.**  $P = \$937.10 = \$40(PVIFA_{r\%,6}) + \$1,000(PVIF_{r\%,6}) ; r = 5.249\%, YTM = 10.498\%$

$$\text{Duration} = (1.05249/.10498) - [ (1.05249 + 3(.08 - .10498)) / (.10498 + .08(1.05249^6 - 1)) ] = 2.715 \text{ years}$$

$$\text{Modified duration} = 2.715/(1.05249) = 2.58 \text{ years}$$

- 24.** Estimated  $P\% = 2.58(.02) = .0516 = (P_1/P_0) - 1 ; P_1 = 1.0516(\$937.10) = \$985.45$

$$\text{Actual } P_1 = \$40(PVIFA_{4.249\%,6}) + \$1,000(PVIF_{4.249\%,6}) = \$987.05$$

## Chapter 11

### Corporate Bonds

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#### Answers to Questions and Problems

##### Core Questions

1. The four main types are debentures, mortgage bonds, collateral trust bonds, and equipment trust certificates.
2. A bond refunding is a call in which an outstanding issue is replaced with a lower coupon issue. The point is simply to replace a relatively high coupon issue with a lower coupon issue. All bond refundings involve a call, but not all calls involve refunding. For example, an issue may be called, but not replaced.
3. Call protection refers to the period during which the bond is not callable, typically five to ten years for a corporate bond. The call premium is the amount above par the issuer must pay to call the bond; it generally declines to zero through time.
4. A put bond gives the owner the right to force the issuer to buy the bond back, typically either at face value or according to a preset price schedule. Obviously, the put feature is very desirable from the owner's perspective, but not the issuer's.
5. All else the same, a callable bond will have a higher coupon rate (because buyers don't like call features and therefore demand a higher coupon); a puttable bond will have a lower coupon rate (because buyers like put features).
6. The conversion price is  $\$1,000/40 = \$25$ .
7. The conversion value is  $80 \times \$10 = \$800$ .
8. A convertible bond converts into the issuer's stock. An exchangeable bond converts into the stock of some other entity. Typically, with an exchangeable bond, the issuer already owns the stock into which the issue can be converted.
9. Event risk refers to a sudden decline in credit quality resulting from a significant structural or financial change. The put feature is intended to protect bondholders against event risk; it works great as long as the issuer has the financial strength to fulfill its obligation to buy back the issue on demand.



10. The advantage is that the coupon adjusts up when interest rates rise, so the bond's price won't fall (at least not nearly as much as it would have). It cuts both ways, however. The coupon will fall if interest rates decline, so the owner will not experience the gains that otherwise would have occurred.

### Intermediate Questions

11. Conceptually, they are the same thing. A put bond gives the owner the right to force the issuer to buy the bond back, typically at face value. An extendible bond gives the owner the right to receive face value on the extension date or receive another bond. In both cases, the owner can have either face value or a bond. In practice, put bonds can be put on multiple dates (usually the coupon dates) whereas an extendible bond may only have one extension date. Also, if an extendible bond is extended, the new bond may not have the same coupon. This answer assumes the bond is extendible at the bondholder's option; some extendible bonds can be extended at the *issuer's* option.
12. Because of the negative convexity effect, callable bonds cannot rise in value as far as noncallable bonds, so they do have less interest rate sensitivity. Also, a callable bond may "mature" sooner than an otherwise identical noncallable issue (because it is called), so this shorter effective maturity also means less interest rate sensitivity. Unfortunately, the smaller interest rate sensitivity is almost all on the upside, so it is not a good thing.
13. The minimum value is the larger of the conversion value and the intrinsic bond value. The conversion value is  $20 \times \$30 = \$600$ . To calculate the intrinsic bond value, note that we have a face value of \$1,000 (by assumption), a semiannual coupon of \$30, an annual yield of 9 percent (4.5 percent per half-year), and 8 years to maturity (16 half-years). Using the standard bond pricing formula from our previous chapter, the bond's price if it were not convertible is \$831.49. Thus, this convertible bond will sell for more than \$831.49.
14. You can convert or tender the bond (i.e., surrender the bond in exchange for the call price). If you convert, you get stock worth  $40 \times \$30 = \$1,200$ . If you tender, you get \$1,050 (105 percent of par). It's a no-brainer: convert.
15. A sinking fund is good in that reduces the probability of default at maturity, but it is bad in that some bondholders may experience adverse calls to satisfy the sinking fund requirement. For a low quality bond, the security issue is more important; however, for a high quality issue, a sinking fund might actually increase the coupon rate. Thus, highly-rated issues often don't have sinking funds.
16. The floating coupon in this case acts like a rocket booster, magnifying the gains and losses that occur from changes in interest rates.

## Chapter 12

### Government Bonds

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#### Answers to Questions and Problems

##### Core Questions

1. T-bills are pure discount, zero-coupon instruments with original maturities of a year or less. T-bonds are straight coupon bonds with original maturities greater than ten years. A small number of T-bonds are callable.
2. The main difference is that T-notes have original maturities of ten years or less. Also, a small number of T-bonds are callable, but no notes are.
3. T-bills and STRIPS.
4. Spreads are generally in the range of one to six ticks, where a tick is  $1/32$ . The main reason that some issues have narrower spreads are that some are much more heavily traded. In particular, the most recently auctioned issues of each maturity (called the “on-the-run” issues) dominate trading and typically have relatively narrow spreads.
5. Agencies have slightly more credit risk. They are subject to state taxes, they have a variety of call features, and they are less liquid (and have wider spreads). These factors translate into a somewhat higher yield. Agencies offer a wider variety of maturities and bond types as well.
6. Treasuries are subject to federal taxes, but not state and local taxes. Munis are tax-exempt at the federal level. They are usually exempt at the state level only within the issuing state. Munis can have significantly greater default risk, and they are, for the most part, much less liquid. Munis are generally callable whereas most Treasuries are not.
7. Serial bonds are bond issues which feature a series of maturity dates, meaning that the entire issue does not come due at once. This structure reduces the chance of a “crisis at maturity” in which the issuer cannot obtain the funds needed to pay off the entire issue in one shot.
8. Variable rate notes (VRNs) are munis with floating coupons.
9. A general obligation (GO) muni is backed by the full faith and credit (i.e., the taxing power) of the issuer. A revenue bond is backed only by the revenue produced from a specific project or activity.

10. A private activity muni is a taxable muni. They are issued to finance activities that do not qualify for tax-exempt status. Since they have no tax preference, they are ordinary bonds much like corporate bonds and appeal to similar investors.

### Intermediate Questions

11. The minimum face value is \$1,000. You must pay the ask price of 127:25, or 127.78125 percent of face. This amounts to \$1,277.8125
12. This is a straight bond valuation just like those in Chapter 10. Using the standard bond pricing formula, verify that the answer is \$966.84724 per \$1,000 face. The price would be quoted at 96:22.
13. This is a standard yield to maturity calculation just like those in Chapter 10. The bellwether issue matures in 30 years. Its ask price is quoted at 101:18, or \$1,015.625 per \$1,000 face. The coupon rate is 5.25 percent, paid semiannually. Given this information, check that the yield is in fact 5.147 percent. Note however that it is important here that the bellwether bond matures in almost exactly 30 years. The standard bond pricing formula implicitly assumes that the first coupon payment is six months away. When this is not true, a modification is necessary to account for the fractional period.
14. These issues are selling well above par, so they will likely be called in 2009 absent a tremendous shift in interest rates. Their yields to call are reported, and these yields reflect the fact the bonds probably will mature early.
15. The equivalent after-tax yield is  $(1 - .28)$  multiplied by 7 percent, or 5.04 percent.
16. The marginal tax rate is  $1 - .06/.08 = 25\%$ .
17. To a certain extent, it's an apples and oranges issue. Munis are much less liquid, have greater default risk, are generally callable fairly early in their lives, and may be subject to state taxes. These factors increase muni yields. As a result, when critical tax rates are calculated, they are likely to be too low. A better approach is compare munis to corporate bonds with similar features and risks. An even better approach is to compare taxable and nontaxable munis.
18. It is true. The reason is that Treasuries are callable at par. Going back to Chapter 10, if two premium bonds have the same price and the same coupon rate, but different maturities (i.e., the call date and the final maturity date), the one with the shorter maturity has the lower yield. This has to be true because of the "pull to par," i.e., the fact that for a given yield a premium bond's price will decline as maturity approaches.
19. It is not true in general because agency securities are frequently callable at prices above par; it may well be that the yield to call is greater for issues selling moderately above par.

20. Once we recognize that this is a premium issue, so its yield to call is reported, this is a straight yield to maturity calculation. We just pretend the issue matures in 2009. The price is \$1,546.5625 per \$1,000 face; the coupon rate is 11.75 percent. It matures in 11 years. Verify that the calculated yield is actually 5.1722, which rounds to 5.17, or six basis points higher than reported. The reason is that the price is rounded to nearest 32<sup>nd</sup> *after* the yield is calculated, so it is often not possible to precisely check the numbers, plus the first coupon will actually arrive in about four months, not exactly six.

## Chapter 13

### Mortgage-Backed Securities

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#### Answers to Questions and Problems

##### Core Questions

1. Mortgage securitization benefits borrowers by reducing interest rates. Interest rates are reduced because securitization increases liquidity in the mortgage market. More liquid mortgages have higher prices and, hence, lower rates.
2. It benefits mortgage originators by allowing them to transfer the risk associated with holding mortgages and instead focus on what they do best, originate mortgages. Also, and equally important, by selling mortgages, originators obtain new funds to loan out.

3. We compute the payment as follows:

$$\$1,329.78 = \frac{\$180,000 \times .08 / 12}{1 - \frac{1}{(1 + .08 / 12)^{30 \times 12}}}$$

4. For the same rate and original balance, the 15-year mortgage will have the higher payments simply because a larger principal payment must be made each month to pay off the loan over a shorter time.
5. Only GNMA is a federal agency, and GNMA securities are backed by the full faith and credit of the U.S. government. The other two, in principle, do not have this backing. As a practical matter, however, the difference is slight.

6. We solve for the mortgage balance as follows:

$$\$1,000 = \frac{\text{Mortgage balance} \times .06 / 12}{1 - \frac{1}{(1 + .06 / 12)^{30 \times 12}}}$$

Solving for the mortgage balance gets us \$166,791.61.

7. It means that timely payment of both principal and interest are guaranteed.

8. Verify that the payment is \$1,027.27. The interest in the first month is equal to the original loan amount (\$140,000) multiplied by the interest rate,  $.08/12 = .067$  (actually  $.0666 \dots$ ) per month. The interest thus amounts to \$933.33. The remaining  $\$1,027.27 - 933.33 = 93.94$  is principal. The interest allocation for the second payment is \$932.71, and the principal reduction is \$94.56.
9. Mortgages are prepaid because the underlying property is sold, interest rates fall, or the owner otherwise wishes to refinance (perhaps to increase the loan balance as a way of obtaining funds for other purposes) or payoff the mortgage. When interest rates fall, prepayments accelerate. Larger drops lead to sharp increases in prepayment rates.
10. First, check that the payment is \$1,264.14 (actually \$1,264.136). We calculate the loan balance as follows:

$$\$1,264.126 = \frac{\text{Mortgage balance} \times .066/12}{1 - \frac{1}{(1 + .065/12)^{20 \times 12}}}$$

Solving for the mortgage balance gets us \$169,552.25. Notice that we used the 20 years remaining in arriving at this balance.

### Intermediate Questions

11. The call feature on a bond gives the borrower the right to buy the bond (i.e., pay off the debt) at a fixed price. The right to prepay on a mortgage gives the borrower the same right.
12. The original payment is (check this) \$1,217.12. After eight years, the balance on the loan (check this; note the remaining life is seven years) is \$75,648.82. For comparability, we calculate the new payments assuming a loan of \$75,648.82, a 7-year life, and a rate of 6 percent. The new payment (check this) is \$1,105.12. Thus, the saving is \$112 per month. Notice that it would be misleading to compare the payments on the old loan to a new, 15-year loan.
13. Prepayments that result purely from interest drops are a risk; they mean that the mortgage investor will have to reinvest at a lower rate. However, some mortgages are prepaid for other reasons, such as the sale of the underlying property. This can happen even if interest rates have risen substantially; such a prepayment benefits the mortgage investors. Thus, not all prepayments are bad, just those result in the need to reinvest at a lower rate.

- 14.** The original payment is (check this) \$873.42. After five years, the balance on the loan (check this; note the remaining life is 25 years) is \$130,865.34. For comparability, we calculate the new payments assuming a loan of the current balance *plus* \$1,000. The reason is that this is the total amount that must be paid to refinance. Thus, we assume a loan of \$131,865.34, a 25-year life, and a rate of 6 percent. The new payment (check this) is \$849.61. Thus, the saving is \$23.81 per month, so it pays to refinance, but not a lot.
- 15.** For a seasoned 100 PSA mortgage, the CPR is 6 percent per year. A 50 (200, 400) PSA is just half (twice, four times), or 3 (12, 24) percent per year. These CPRs have two more or less equivalent interpretations. They are an estimate of the probability that any given mortgage in the pool will prepay in a given year. A more useful interpretation is that they are an estimate of the percentage of outstanding principal that will be prepaid in a given year. In other words, if the odds of prepayment are 6 percent for any given mortgage, then we expect that 6 percent of all mortgages will prepay, meaning that 6 percent of the principal in a mortgage pool will be prepaid per year.
- 16.** We calculate SMMs as follows:

$$\text{SMM} = 1 - (1 - \text{CPR})^{1/12}$$

Given the answers in the previous problem, it's mostly a matter of plug and chug. The answers are .254 percent (50 PSA), 1.06 percent (200 PSA), and 2.26 percent (400 PSA). Notice that the 400 PSA is not simply double the 200; there's a compound interest-type effect in the calculation.

- 17.** A collateralized mortgage obligation (CMO) is a mortgage-backed security with cash flows that are divided into multiple securities. They exist because they provide a means of altering some of the less desirable characteristics of MBS's, thereby increasing marketability to a broader class of investors. More fundamentally, they exist because investment banks (the creators and marketers) have found them to be a profitable product!
- 18.** Every mortgage payment has an interest portion and a principal portion. IO and PO strips are very simple CMO's; the interest and principal portions are separated into distinct payments. Holders of IO strips receive all the interest paid; the principal goes to holders of PO strips. If interest rates never change, the IO strips—especially the longer dated ones—are vastly more risky. With PO strips, the only uncertainty is when the principal is paid. All PO strips-holders will receive full payment. With an IO strip, however, prepayment means that no future interest payments will be made, so the amount of interest that will be received is unknown.

19. PO strips have greater interest rate risk, where we define interest rate risk to mean losses associated with interest rate increases and gains associated with decreases. When interest rates go up, prepayments slow down, thereby postponing the time until principal is received. IO strips can actually behave like “inverse floaters,” their value tends to *rise* when interest rates increase. The reason is that slowing prepayments increases the interest that will be received by IO strips-holders.
20. The A-tranche will essentially receive all of the payments, both principal and interest until it is fully paid off. The Z-tranche receives nothing until the A-tranche is paid off. After that, the Z-tranche receives everything. The Z-tranche is much riskier because the size and timing of the payment is not known.
21. With a protected amortization class (PAC) CMO, payments are made to one group of investors according to a set schedule. This means that the protected class investors have almost fully predictable cash flows. After protected class investors are paid, all the remaining cash flow goes to non-PAC investors, who hold PAC support or PAC companion bonds. In essence, one group of investors receives fixed payments, the other group absorbs all (or virtually all) the uncertainty created by prepayments.
22. Macaulay duration assumes fixed cash flows. With MBS's and CMO's, the payments depend on prepayments, which in turn depend on interest rates. When prepayments pick up, duration falls, and vice versa. Thus, no single measure is accurate.



## Chapter 14

### Stock Options

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#### Answers to Questions and Problems

##### Core Questions

1. Assuming American-style exercise, a call option confers the right, without the obligation, to buy an asset at a given price on or before a given date. An American-style put option confers the right, without the obligation, to sell an asset at a given price on or before a given date. European-style options are the same except that exercise can only occur at maturity. One reason you would buy a call option is that you expect the price of the asset to increase. Similarly, you would buy a put option if you expect the price of the asset to decrease. In both cases, other reasons exist, but these are the basic ones. A call option has unlimited potential profit, while a put option has limited potential profit; the underlying asset's price cannot be less than zero.
2.
  - a. The buyer of a call option pays money for the right to buy....
  - b. The buyer of a put option pays money for the right to sell....
  - c. The seller of a call option receives money for the obligation to sell....
  - d. The seller of a put option receives money for the obligation to buy....
3. Your options are worth  $\$60 - \$50 = \$10$  each, or \$1,000 per contract. With five contracts, the total value is \$5,000. Your net profit is \$5,000 less the \$1,000 (5 contracts at \$200 each) you invested, or \$4,000.
4. Your options are worth  $\$30 - \$20 = \$10$  each, or \$1,000 per contract. With eight contracts, the total value is \$8,000. Your net profit is \$8,000 less the \$2,400 (8 contracts at \$300 each) you invested, or \$5,600.
5. The stock costs \$100 per share, so if you invest \$10,000, you'll get 100 shares. The option premium is \$5, so an option contract costs \$500. If you invest \$10,000, you'll get  $\$10,000 / \$500 = 20$  contracts. If the stock is selling for \$120 in 90 days, your profit on the stock is \$20 per share, or \$2,000 total. The percentage gain is  $\$2,000 / \$10,000 = 20\%$ .  
 Similarly, in this case, your options are worth \$20 per share, or \$2,000 per contract. However, you have 20 contracts, so your options are worth \$40,000 in all. Since you paid \$10,000 for the 20 contracts, your profit is \$30,000. Your percentage gain is a pleasant  $\$30,000 / \$10,000 = 300\%$ .  
 If the stock is selling for \$100, your profit is \$0 on the stock, so your percentage return is 0%. Your option is worthless (why?); the percentage loss is -100%. If the stock is selling for \$80, verify that your percentage loss on the stock is -20% and your loss on the option is again -100%.

6. 60 contracts at \$700 per contract = \$42,000
7. Stock price = \$95: option value =  $60(100)(\$95 - \$80) = \$90,000$   
 Stock price = \$86: option value =  $60(100)(\$86 - \$80) = \$36,000$ .
8. Initial cost =  $25(100)(\$4.25) = \$10,625$ ; maximum gain =  $25(100)(\$80) - \$10,625 = \$189,375$ . Terminal value =  $25(100)(\$80 - \$55) = \$62,500$ ; net gain =  $\$62,500 - \$10,625 = \$51,875$
9. Stock price = \$55: net loss =  $\$10,625 - \$62,500 = -\$51,875$ .  
 Stock price = \$100: net gain = \$10,625.  
 The breakeven stock price is the \$80 exercise price less the premium of \$4.25, or \$75.75. For terminal stock prices above \$75.75, the premium received more than offsets any loss, so the writer of the put option makes a net profit (ignoring the effects of the time value of money).
10. In general, the breakeven stock price for a call purchase is the exercise price plus the premium paid. For stock prices higher than this, the purchaser realizes a profit. For a put purchase, it's the strike price less the premium. For stock prices lower than this, the purchaser realizes a profit.

### Intermediate Questions

11. If you buy a put option on a stock that you already own, you guarantee that you can sell the stock for the strike price on the put. Thus, you have in effect insured yourself against stock price declines beyond this point. This is the protective put strategy.
12. The intrinsic value of a call option is  $\max\{S - K, 0\}$ . It is the value of the option at expiration.
13. The value of a put option at expiration is  $\max\{K - S, 0\}$ . By definition, the intrinsic value of an option is its value at expiration, so  $\max\{K - S, 0\}$  is the intrinsic value of a put option.
14. You get to keep the premium in all cases. For 20 contracts and a \$2 premium, that's \$4,000. If the stock price is \$30 or \$40, the options expire worthless, so your net profit is \$4,000. If the stock price is \$50, you lose \$10 per share on each of 2,000 shares, or \$20,000 in all. You still have the premium, so your net loss is \$16,000.
15. You get to keep the premium in all cases. For 10 contracts and a \$1 premium, that's \$1,000. If the stock price is \$20 or \$30, the options expire worthless, so your net profit is \$1,000. If the stock price is \$10, you lose \$10 per share on each of 1,000 shares, or \$10,000 in all. You still have the premium, so your net loss is \$9,000.

16. The contract costs \$2,000. At maturity, an in-the-money SPX option is worth 100 times the difference between the S&P index and the strike, or \$5,000 in this case. Your net profit is \$3,000.
17. The call is selling for less than its intrinsic value; an arbitrage opportunity exists. Buy the call for \$10, exercise the call by paying \$35 in return for a share of stock, and sell the stock for \$50. You've made a riskless \$5 profit.
18. 42 contracts were traded, 25 calls and 17 puts; this represents options on 4,200 shares of Milson stock.
19. The calls are in the money. The intrinsic value of the calls is \$4.
20. The puts are out of the money. The intrinsic value of the puts is \$0.
21. The March call and the October put are mispriced. The call is mispriced because it is selling for less than its intrinsic value. The arbitrage is to buy the call for \$3.50, exercise it and pay \$55 for a share of stock, and sell the stock for \$59 for a riskless profit of \$0.50. The October put is mispriced because it sells for less than the July put. To take advantage of this, sell the July put for \$3.63 and buy the October put for \$3.25, for a cash inflow of \$0.38. The exposure of the short position is completely covered by the long position in the October put, with a positive cash inflow today.
22. The covered put would represent writing put options on the stock. This strategy is analogous to a covered call because the upside potential of the underlying position, (which in the case of a short sale would be a decline in the stock price), is capped in exchange for the receipt of the option premium for certain.

The protective call would represent the purchase of call options as a form of insurance for the short sale position. If the stock price rises, then losses incurred on the short sale are offset, or insured, by gains on the call options; however, if the stock price falls, which represents a profit to the short seller, then only the purchase price of the option is lost.

## Chapter 15

### Option Valuation

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#### Answers to Questions and Problems

##### Core Questions

1. The six factors are the stock price, the strike price, the time to expiration, the risk-free interest rate, the stock price volatility, and the dividend yield.
2. Increasing the time to expiration increases the value of an option. The reason is that the option gives the holder the right to buy or sell. The longer the holder has that right, the more time there is for the option to increase in value. For example, imagine an out-of-the-money option that is about to expire. Because the option is essentially worthless, increasing the time to expiration obviously would increase its value.
3. An increase in volatility acts to increase both put and call values because greater volatility increases the possibility of favorable in-the-money payoffs.
4. An increase in dividend yields reduces call values and increases put values. The reason is that, all else the same, dividend payments decrease stock prices. To give an extreme example, consider a company that sells all its assets, pays off its debts, and then pays out the remaining cash in a final, liquidating dividend. The stock price would fall to zero, which is great for put holders, but not so great for call holders.
5. Interest rate increases are good for calls and bad for puts. The reason is that if a call is exercised in the future, we have to pay a fixed amount at that time. The higher is the interest rate, the lower is the present value of that fixed amount. The reverse is true for puts in that we receive a fixed amount.
6. Rearranging the put-call parity condition to solve for  $P$ , the put price, and plugging in the other numbers get us:

$$\begin{aligned}
 P &= C - S + Ke^{-rT} \\
 &= \$10 - \$85 + \$80e^{-.06 \times .25} \\
 &= \$3.81
 \end{aligned}$$

7. Rearranging the put-call parity condition to solve for  $S$ , the stock price, and plugging in the other numbers get us:

$$\begin{aligned} S &= C - P + Ke^{-rT} \\ &= \$10 - \$8 + \$80e^{-.04 \times .25} \\ &= \$81.20 \end{aligned}$$

8. Using the option calculator with the following inputs:

$$\begin{aligned} S &= \text{current stock price} = \$100, \\ K &= \text{option strike price} = \$70, \\ r &= \text{risk-free rate} = .05, \\ \sigma &= \text{stock volatility} = .30, \text{ and} \\ T &= \text{time to expiration} = 30 \text{ days} \end{aligned}$$

results in a call option price of \$30.29.

9. Using the option calculator with the following inputs:

$$\begin{aligned} S &= \text{current stock price} = \$20, \\ K &= \text{option strike price} = \$22, \\ r &= \text{risk-free rate} = .04, \\ \sigma &= \text{stock volatility} = .50, \\ T &= \text{time to expiration} = 60 \text{ days, and} \\ y &= \text{dividend yield} = .02 \end{aligned}$$

results in a call option price of \$.90.

10. Using the option calculator with the following inputs:

$$\begin{aligned} S &= \text{current stock price} = \$60, \\ K &= \text{option strike price} = \$65, \\ r &= \text{risk-free rate} = .05, \\ \sigma &= \text{stock volatility} = .25, \text{ and} \\ T &= \text{time to expiration} = 180 \text{ days} \end{aligned}$$

results in a put option price of \$6.24.

11. The call is worth more. To see this, we can rearrange the put-call parity condition as follows:

$$C - P = S - Ke^{-rT}$$

If the options are at the money,  $S = K$ , so the right-hand side of this expression is equal to the strike minus the present value of the strike price. This is necessarily positive.

Intuitively, if both options are at the money, the call option offers a much bigger potential payoff, so it's worth more.

12. Looking at the previous answer, if the call and put have the same price (i.e.,  $C - P = 0$ ), it must be that the stock price is equal to the present value of the strike price, so the put is in the money.
13. Looking at Question 7 above, a stock can be replicated by a long call (to capture the upside gains), a short put (to reflect the downside losses), and a T-bill (to capture the time-value component—the “wait” factor).
14. An option's delta tells us the (approximate) dollar change in the option's value that will result from a change in the stock price. If a call sells for \$2.00 with a delta of .60, a \$1 stock price increase will add \$.60 to option price, increasing it to \$2.60.
15. The delta relates dollar changes in the stock to dollar changes in the option. The eta relates percentage changes. So, the stock price rises by 2 percent (\$100 to \$102), an eta of 12 implies that the option price will rise by 24 percent.
16. Vega relates the change in volatility in percentage points to the dollar change in the option's price. If volatility rises from 50 to 51 percent, a 1 point rise, and vega is .60, then the option's price will rise by 60 cents.
17. The reason is that a call option on a non-dividend-paying stock is always worth more alive than dead, meaning that you will always get more from selling it than exercising it. If you exercise it, you only get the intrinsic value. If you sell it, you get intrinsic value at a minimum plus any remaining time value. For a put, however, early exercise can be optimal. Suppose, for example, the stock price drops to zero. That's as good as it gets, so we would like to go ahead and exercise. It will actually pay to exercise early for some stock price greater than zero, but no general formula is known for the critical stock price.

- 18.** We have to use trial and error to find the answer (there is no other way). Using the option calculator with the following inputs:

$S$	= current stock price	= \$100,
$K$	= option strike price	= \$120,
$r$	= risk-free rate	= .06,
$\sigma$	= stock volatility	= ??,
$T$	= time to expiration	= 100 days,
$y$	= dividend yield	= .03,

we try different values for the volatility until a call price of \$2.57 results. Verify that  $\sigma = 40\%$  does the trick.

- 19.** You can either buy put options or sell call options. In either case, gains or losses on your stock portfolio will be offset by gains or losses on your option contracts. To calculate the number of contracts needed to hedge a \$150 million portfolio with a beta of 1.4 using an option contract value of \$120,000 (100 times the index) and a delta of .50, we use the formula from the chapter:

$$\text{Number of option contracts} = \frac{\text{Portfolio beta} \times \text{Portfolio value}}{\text{Option delta} \times \text{Option contract value}}$$

Filling in the numbers, we need to sell  $1.4 \times \$150\text{M} / (.5 \times \$120,000) = 3,500$  contracts.

20. Using the option calculator with the following inputs:

$S$  = current stock price = \$80,  
 $K$  = option strike price = \$75,  
 $r$  = risk-free rate = .05,  
 $\sigma$  = stock volatility = .40,  
 $T$  = time to expiration = 365 days, and  
 $y$  = dividend yield = 3 percent,

results in the following prices and “greeks:”

	Call	Put
Value	\$15.21	\$8.92
Delta	.640	-.330
Gamma	.011	.011
Rho	.360	-.353
Eta	3.366	-2.963
Vega	.285	.285
Theta	.016	.015



## Chapter 16

### Futures Contracts

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#### Answers to Questions and Problems

##### Core Questions

1.
  - a. Three are visible in Figure 16.1; wheat futures are traded on the Chicago Board of Trade (CBT), Kansas City Board of Trade (KC), and Minneapolis Grain Exchange (MPLS). There are two others, the Winnipeg Commodity Exchange (WPG) and the MidAmerica Commodity Exchange (MCE), not shown in Figure 16.1. Of these, the largest trading activity occurs in Chicago.
  - b. 1,000 troy oz..
  - c. At 5,000 bu. per contract, you must deliver 100,000 bushels.
  - d. The April contract has the largest open interest and the October contract has the smallest open interest.
2.
  - a. The settle price is 231.75 cents per bushel. One contract is valued as the contract size times the per unit price, so  $5,000 \times \$2.3175 = \$11,587.5$ .
  - b. The settle price is 123-23, or 123.71875% of par value. The value of a position in 10 contracts is  $10 \times \$100,000 \times 1.2371875 = \$1,237,187.5$ .
  - c. The index futures price was up 6.65 for the day, or  $\$500 \times 6.65 = \$3,325$ . For a position in 25 contracts, this represents a change in value of  $25 \times \$3,325 = \$83,125$ , which represents a gain to a long position and a loss to a short position.
  - d. The contract closed down 11 for the day, so a short position would have made a profit of  $10 \times 60,000 \times \$0.0011 = \$660$ .
3. The contract settled down .25, so a long position loses:  $20 \times 5,000 \times \$0.0025 = \$250$ .
4. The contract settled down .75, so a short position gains:  $15 \times 5,000 \times \$0.0075 = \$562.50$ .
5. The contract settled up 6 points, so a short position loses:  $30 \times \$100,000 \times (6/3200) = \$5,625$ .
6. Long hedge; i.e., buy corn futures. If corn prices do rise, then the futures position will show a profit, offsetting the losses from higher corn prices when they are purchased.
7. Short the index futures. If the S&P 500 index subsequently declines in a market sell-off, the futures position will show a profit, offsetting the losses on the portfolio of stocks.

8. Sell the futures. If interest rates rise, causing the value of the bonds to be less at the time of sale, the corresponding futures hedge will show a profit. Buy yen futures. If the value of the dollar depreciates relative to the yen in the intervening four months, then the dollar/yen exchange rate will rise, and the payment required by the importer in dollars will rise. A long yen futures position would profit from the dollar's depreciation and offset the importer's higher invoice cost.
9. Sell crude oil futures. Price declines in the oil market would be offset by a gain on the short position.

### Intermediate Questions

10. The total open interest on the D-mark is 61,889 contracts. This is the number of contracts. Each contract has a long and a short, so the open interest represents either the number of long positions or the number of short positions. Each contract calls for the delivery of DM 125,000, and the settle price on the March contract is \$.5648 per mark, or  $$.5648 \times 125,000 = \$70,600$ . With 61,889 contracts, the total dollar value is about \$4.4 billion.
11. If the contract settles down, a long position loses money. The loss per contract is:  $42,000 \times \$0.01 = \$420$ , so when the account is marked-to-market and settled at the end of the trading day, your balance is \$580, which is less than the maintenance margin. The minimum price change for a margin call is  $\$250 = 42,000 \times X$ , or  $X = \$0.00595 = 0.595$  cents per pound.
12. It is true. Each contract has a buyer and a seller, a long and a short. One side can only profit at the expense of the other. Including commissions, futures contracts, like most derivative assets, are actually negative sum gains. This doesn't make them inappropriate tools, by the way; it just means that, on average and before commissions, they are a break-even proposition.
13. Establish your account at an initial margin of  $20 \times \$1,200 = \$24,000$ . Your maintenance margin is  $20 \times \$800 = \$16,000$ . The initial value of the position is  $20 \times 42,000 \times \$0.545 = \$457,800$ .
 

Day 1:           New position value =  $20 \times 42,000 \times \$0.555 = \$466,200$ , for a loss of \$8,400. Your margin account balance is now \$15,600, so you face a margin call. Put another \$8,400 in your account to bring it up.

Day 2:           New position value =  $20 \times 42,000 \times \$0.560 = \$470,400$ , for a loss of \$4,200. Your margin account balance is now \$19,800.

Day 3: New position value =  $20 \times 42,000 \times \$0.540 = \$453,600$ , for a profit of \$16,800. Your margin account balance is now \$36,600

Day 4: New position value =  $20 \times 42,000 \times \$0.520 = \$436,800$ , for a profit of \$16,800. Your margin account balance is now \$53,400.

Your total profit is thus  $\$53,400 - \$8,400 - \$24,000 = \$21,000$

14.  $F = \$90(1 + .06 - .04)^{1/4} = \$90.45$
15. Parity implies that  $F = 1,800(1 + .06 - .03)^{1/2} = 1,826.80$ . If the parity relationship holds, the futures price should be 1,826.80. At 1,850, the futures are currently overpriced; thus, you would want to buy the index and sell the futures.
16. The closing value of the Midcap 400 index futures is  $366 \times \$500 = \$183,000$ , so the desired hedge is  $1.15 \times \$200M/\$183,000 = 1,257$  contracts. Assuming the mutual fund is long stocks, the likely hedge would then be to sell 1,257 Midcap 400 futures.
17. In reality, two factors in particular make stock index arbitrage more difficult than it might appear. First, the dividend yield on the index depends on the dividends that will be paid over the life of the contract; this is not known with certainty and must, therefore, be estimated. Second, buying or selling the entire index is feasible, but index staleness (discussed in our first stock market chapter) is an issue; the current up-to-the-second price of the index is not known because not all components will have just traded. Trading costs have to be considered as well.  
Thus, there is some risk in that the inputs used to determine the correct futures price may be incorrect, and what appears to be a profitable trade really is not. Program traders usually establish bounds, meaning that no trade is undertaken unless a deviation from parity exceeds a preset amount. Setting the bounds is itself an issue. If they are set too narrow, then the risks described above exist. If they are set too wide, other traders will step in sooner and eliminate the profit opportunity.
18. The spot-futures parity condition is:

$$F = S(1 + r - d)^T,$$

where  $S$  is the spot price,  $r$  is the risk-free rate,  $d$  is the dividend yield,  $F$  is the futures price, and  $T$  is the time to expiration measured in years.

Plugging in the numbers we have, with 1/2 for the number of years (6 months out 12), gets us:

$$1200 = 1194(1 + X)^{1/2}$$

Solving for  $X$ , the difference between  $r$  and  $d$ , we get 1 percent.

19. The formula for the number of U.S. Treasury note futures contracts needed to hedge a bond portfolio is:

$$\text{Number of contracts} = \frac{D_P \times V_P}{D_F \times V_F}$$

where  $V_P$  is the value of the bond portfolio,  
 $D_P$  is the duration of the bond portfolio,  
 $D_F$  is the duration of the futures contract,  
 $V_F$  is the value of a single futures contract.

The duration of the futures contract is the duration of the underlying instrument, plus the time remaining until contract maturity, i.e.,

$$D_F = D_U + M_F$$

where  $D_F$  is the duration of the futures contract,  
 $D_U$  is the duration of the underlying instrument, and  
 $M_F$  is the time remaining until contract maturity.

In our case, the duration of the underlying U.S. Treasury note is 9 years and the futures contract has 90 days to run, so  $D_F = 9.25$ . The face value of the note contract is 102 percent of \$100,000, or \$102,000. Plugging in the numbers, we have:

$$3,816 \text{ contracts} = \frac{6 \times \$600,000,000}{9.25 \times \$102,000}$$

You therefore need to sell 3,816 contracts to hedge this \$600 million portfolio.

## Chapter 17

### Diversification and Asset Allocation

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#### Answers to Questions and Problems

##### Core Questions

1.  $.2 \times (-.10) + .5 \times (.20) + .3 \times (.30) = 17\%$
2.  $.2 \times (-.10 - .17)^2 + .5 \times (.20 - .17)^2 + .3 \times (.30 - .17)^2 = .0201$ ; taking the square root,  $\sigma = 14.1774\%$ .
3.  $(1/3) \times (-.10) + (1/3) \times (.20) + (1/3) \times (.30) = 13.333 \dots \%$   
 $(1/3) \times (-.10 - .17)^2 + (1/3) \times (.20 - .17)^2 + (1/3) \times (.30 - .17)^2 = .030233$  ; taking the square root,  $\sigma = 17.3877\%$ .

4.

<i>Calculating Expected Returns</i>					
(1) State of Economy	(2) Probability of State of Economy	Roll		Ross	
		(3) Return if State Occurs	(4) Product (2) $\times$ (3)	(5) Return if State Occurs	(6) Product (2) $\times$ (5)
Bust	.30	-10%	-.03	40%	.12
Boom	.70	50%	.35	10%	.07
		E(R) =	32%	E(R) =	19%

5.

(1) State of Economy	(2) Probability of State of Economy	(3) Return Deviation from Expected Return	(4) Squared Return Deviation	(5) Product (2) × (4)
<i>Roll</i>				
Bust	.30	-.42	.1764	.05292
Boom	.70	.18	.0324	.02268
			$\sigma^2 =$	.0756
<i>Ross</i>				
Bust	.30	.21	.0441	.01323
Boom	.70	-.09	.0081	.00567
			$\sigma^2 =$	.0189

Taking square roots, the standard deviations are 27.4955% and 13.7477%.

6.

<i>Expected Portfolio Return</i>			
(1) State of Economy	(2) Probability of State of Economy	(3) Portfolio Return if State Occurs	(4) Product (2) × (3)
Bust	.30	20%	.06
Boom	.70	26%	.182
		$E(R_p) =$	24.2%

7.

<i>Calculating Portfolio Variance</i>				
(1) State of Economy	(2) Probability of State of Economy	(3) Portfolio Returns if State Occurs	(4) Squared Deviation from Expected Return	(5) Product (2) × (4)
Bust	.30	.05	.053361	.016008
Boom	.70	.38	.009801	.006861
				$\sigma_P^2 = .022869$
				$\sigma_P = 15.1225\%$

8. Based on market history, the average annual standard deviation of return for a single, randomly chosen stock is about 50 percent. The average annual standard deviation for an equally-weighted portfolio of many stocks is about 20 percent, or 60 percent less.
9. If the returns on two stocks are highly correlated, they have a strong tendency to move up and down together. If they have no correlation, there is no particular connection between the two. If they are negatively correlated, they tend to move in opposite directions.
10. An efficient portfolio is one that has the highest return for its level of risk.
11. Notice that we have historical information here, so we calculate the sample average and sample standard deviation (using  $n - 1$ ) just like we did in Chapter 1. Notice also that the portfolio has less risk than either asset.

Annual Returns on Stocks A and B			
Year	Stock A	Stock B	Portfolio AB
1995	15%	55%	39%
1996	35	-40	-10
1997	-15	45	21
1998	20	0	8
1999	0	10	6
Avg returns	11%	14%	12.8%
Std deviations	19.17%	37.98%	18.32%

Intermediate Questions

12. Given the following information, calculate the expected return and standard deviation for portfolio that has 40 percent invested in Stock A, 30 percent in Stock B, and the balance in Stock C.

State of Economy	Probability of State of Economy	Returns			
		Stock A	Stock B	Stock C	Portfolio
Boom	.40	15%	18%	20%	17.4%
Bust	.60	5	0	-5	.5%

$$E(R_P) = .4 \times (.174) + .6 \times (.005) = 7.26\%$$

$$\sigma_P^2 = .4 \times (.174 - .0726)^2 + .6 \times (.005 - .0726)^2 = .006855; \text{ taking the square root, } \sigma_P = 8.2793\%.$$

13.  $E(R_P) = .4 \times (.30) + .6 \times (.26) = 27.6\%$   
 $\sigma_P^2 = .4^2 \times .65^2 + .6^2 \times .45^2 + 2 \times .4 \times .6 \times .65 \times .45 \times .3 = .18626; \sigma_P = 42.73\%.$

14.  $\sigma_P^2 = .4^2 \times .65^2 + .6^2 \times .45^2 + 2 \times .4 \times .6 \times .65 \times .45 \times 1 = .2809; \sigma_P = 53\%.$   
 $\sigma_P^2 = .4^2 \times .65^2 + .6^2 \times .45^2 + 2 \times .4 \times .6 \times .65 \times .45 \times 0 = .1405; \sigma_P = 37.48\%.$   
 $\sigma_P^2 = .4^2 \times .65^2 + .6^2 \times .45^2 + 2 \times .4 \times .6 \times .65 \times .45 \times (-1) = .0001; \sigma_P = 1\%.$

15.  $(.45^2 - .65 \times .45 \times .3)/(.45^2 + .65^2 - 2 \times .65 \times .45 \times .3) = .255$   
 $E(R_P) = .255 \times (.30) + .745 \times (.26) = 27.02\%$   
 $\sigma_P^2 = .255^2 \times .65^2 + .745^2 \times .45^2 + 2 \times .255 \times .745 \times .65 \times .45 \times .3 = .1732$   
 $\sigma_P = 41.6\%.$



16.

<i>Risk and Return with Stocks and Bonds</i>			
Portfolio Weights		Expected Return	Standard Deviation
Stocks	Bonds		
1.00	0.00	14.00%	20.00%
0.80	0.20	12.20%	15.92%
0.60	0.40	10.40%	12.11%
0.40	0.60	8.60%	8.91%
0.20	0.80	6.80%	7.20%
0.00	1.00	5.00%	8.00%

17. True.

18. False.

19. Look at  $\sigma_p^2$ :

$$\begin{aligned}\sigma_p^2 &= (x_A \times \sigma_A + x_B \times \sigma_B)^2 \\ &= x_A^2 \times \sigma_A^2 + x_B^2 \times \sigma_B^2 + 2 \times x_A \times x_B \times \sigma_A \times \sigma_B \times 1, \text{ which is precisely the} \\ &\text{expression for the variance on a two-asset portfolio when the correlation is +1.}\end{aligned}$$

20. Look at  $\sigma_p^2$ :

$$\begin{aligned}\sigma_p^2 &= (x_A \times \sigma_A - x_B \times \sigma_B)^2 \\ &= x_A^2 \times \sigma_A^2 + x_B^2 \times \sigma_B^2 + 2 \times x_A \times x_B \times \sigma_A \times \sigma_B \times (-1), \text{ which is precisely the} \\ &\text{expression for the variance on a two-asset portfolio when the correlation is -1.}\end{aligned}$$

21. From the previous question, with a correlation of -1:

$$\sigma_p = x_A \times \sigma_A - x_B \times \sigma_B = x \times \sigma_A - (1 - x) \times \sigma_B$$

Set this to equal zero and solve for  $x$  to get:

$$\begin{aligned}0 &= x \times \sigma_A - (1 - x) \times \sigma_B \\ x &= \sigma_B / (\sigma_A + \sigma_B)\end{aligned}$$

This is the weight on the first asset.

22. If two assets have zero correlation and the same standard deviation, then evaluating the general expression for the minimum variance portfolio shows that  $x = 1/2$ ; in other words, an equally-weighted portfolio is minimum variance.

23. Let  $\rho$  stand for the correlation, then:

$$\begin{aligned}\sigma_p^2 &= x_A^2 \times \sigma_A^2 + x_B^2 \times \sigma_B^2 + 2 \times x_A \times x_B \times \sigma_A \times \sigma_B \times \rho \\ &= x^2 \times \sigma_A^2 + (1 - x)^2 \times \sigma_B^2 + 2 \times x \times (1 - x) \times \sigma_A \times \sigma_B \times \rho\end{aligned}$$

Take the derivative with respect to  $x$  and set equal to zero:

$$d\sigma_p^2/dx = 2 \times x \times \sigma_A^2 - 2 \times (1 - x) \times \sigma_B^2 + 2 \times \sigma_A \times \sigma_B \times \rho - 4 \times x \times \sigma_A \times \sigma_B \times \rho = 0$$

Solve for  $x$  to get the expression in the text.

## Chapter 18

### Return, Risk, and the Security Market Line

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#### Answers to Questions and Problems

##### Core Questions

1. Some of the risk in holding any asset is unique to the asset in question. By investing in a variety of assets, this unique portion of the total risk can be eliminated at little cost. On the other hand, there are some risks that affect all investments. This portion of the total risk of an asset cannot be costlessly eliminated. In other words, systematic risk can be controlled, but only by a costly reduction in expected returns.
  
2. If the market expected the growth rate in the coming year to be 2 percent, then there would be no change in security prices if this expectation had been fully anticipated and priced. However, if the market had been expecting a growth rate different than 2 percent and the expectation was incorporated into security prices, then the government's announcement would most likely cause security prices in general to change; prices would drop if the anticipated growth rate had been more than 2 percent, and prices would rise if the anticipated growth rate had been less than 2 percent.
  
3.
  - a. systematic
  - b. unsystematic
  - c. both; probably mostly systematic
  - d. unsystematic
  - e. unsystematic
  - f. systematic
  
4.
  - a. an unexpected, systematic event occurred; market prices in general will most likely decline.
  - b. no unexpected event occurred; company price will most likely stay constant.
  - c. no unexpected, systematic event occurred; market prices in general will most likely stay constant.
  - d. an unexpected systematic risk has occurred; company price will most likely decline.
  - e. no unexpected, systematic event occurred unless the outcome was a surprise; market prices in general will most likely stay constant.
  
5. False. Expected returns depend on systematic risk, not total risk.
  
6.  $\beta_p = .3(1.2) + .2(.6) + .1(1.5) + .4(.8) = .95$

7.  $\beta_p = 1.0 = 1/3(0) + 1/3(1.6) + 1/3(\beta_X) ; \beta_X = 1.4$
8.  $E[r_i] = .08 + (.17 - .08)(1.2) = .188$
9.  $E[r_i] = .13 = .07 + .08\beta_i ; \beta_i = .75$
10.  $E[r_i] = .17 = .075 + (E[r_{mkt}] - .075)(.9); E[r_{mkt}] = .1806$
11.  $E[r_i] = .22 = r_f + (.16 - r_f)(1.6); r_f = .06$
12. a.  $E[r_p] = (.13 + .07)/2 = .1$   
 b.  $\beta_p = 0.6 = x_S(0.9) + (1 - x_S)(0) ; x_S = 0.6/0.9 = .6667 ; x_{rf} = 1 - .6667 = .3333$   
 c.  $E[r_p] = .11 = .13x_S + .07(1 - x_S); x_S = 2/3; \beta_p = 2/3(0.9) + 1/3(0) = 0.6$   
 d.  $\beta_p = 1.8 = x_S(0.9) + (1 - x_S)(0) ; x_S = 1.8/0.9 = 2; x_{rf} = 1 - 2 = -1$   
 The portfolio is invested 200% in the stock and -100% in the risk-free asset. This represents borrowing at the risk-free rate to buy more of the stock.

### Intermediate Questions

13.  $\beta_p = x_W(1.6) + (1 - x_W)(0) = 1.6x_W$   
 $E[r_W] = .25 = .07 + \text{MRP}(1.60) ; \text{MRP} = .18/1.6 = .1125$   
 $E[r_p] = .07 + .1125 \beta_p$ ; slope of line = MRP = .1125;  $E[r_p] = .07 + .1125 \beta_p = .07 + .18x_W$

$x_W$	$E[r_p]$	$\beta_p$	$x_W$	$E[r_p]$	$\beta_p$
0%	.070	0.0	100%	.250	1.6
25	.115	0.4	125	.295	2.0
50	.160	0.8	150	.340	2.4
75	.205	1.2			

14.  $E[r_i] = .06 + .113\beta_i$   
 $.25 > E[r_Y] = .06 + .113(1.59) = .2397$ ; Y plots above the SML and is undervalued.  
 $.12 > E[r_Z] = .06 + .113(0.44) = .1097$ ; Z plots above the SML and is undervalued.
15.  $[(.25 - r_f)/1.59] = [(.12 - r_f)/0.44]; r_f = .0703$
16.  $(E[r_A] - r_f)/\beta_A = (E[r_B] - r_f)/\beta_B$   
 $\beta_A/\beta_B = (E[r_A] - r_f)/(E[r_B] - r_f)$

17. Here we have two equations in two unknowns:

$$\begin{aligned} E[r_{\text{Oxy Co.}}] &= .23 = r_f + 1.35(r_m - r_f); & E[r_{\text{More-On Co.}}] &= .17 = r_f + .9(r_m - r_f) \\ .23 &= r_f + 1.35r_m - 1.35r_f = 1.35r_m - .35r_f; & .17 &= r_f + .9(r_m - r_f) = r_f + .9r_m - .9r_f \\ r_f &= (1.35r_m - .23)/.35 & r_m &= (.17 - .1r_f)/.9 = .18889 - .1111r_f \end{aligned}$$

$$r_f = [1.35(.18889 - .1111r_f) - .23]/.35$$

$$1.42857r_f = .07143$$

$$r_f = .05$$

$$r_m = (.17 - .1r_f)/.9 = .18889 - .1111r_f = (.17 - .005)/.9 = .1833$$

18. Earnings contain information about recent sales and costs. This information is useful for projecting future growth rates and cash flows. Thus, unexpectedly low earnings often lead market participants to reduce estimates of future growth rates and cash flows; price drops are the result. The reverse is often true for unexpectedly high earnings.
19. Yes. It is possible, in theory, for a risky asset to have a beta of zero. Such an asset's return is simply uncorrelated with the overall market. Based on the CAPM, this asset's expected return would be equal to the risk-free rate. It is also possible to have a negative beta; the return would be less than the risk-free rate. A negative beta asset would carry a negative risk premium because of its value as a diversification instrument. A negative beta asset can be created by shorting an asset with a positive beta. A portfolio with a zero beta can always be created by combining long and short positions.
20. The rule is always "buy low, sell high." In this case, we buy the undervalued asset and sell (short) the overvalued one. It does not matter whether the two securities are misvalued with regard to some third security; all that matters is their relative value. In other words, the trade will be profitable as long as the relative misvaluation disappears; however, there is no guarantee that the relative misvaluation will disappear, so the profits are not certain.
21. From the chapter,  $\beta_i = \text{Corr}(r_i, r_M) \times (\sigma_i / \sigma_M)$ . Also,  $\text{Corr}(r_i, r_M) = \text{Cov}(r_i, r_M) / (\sigma_i \times \sigma_M)$ . Substituting this second result into the expression for  $\beta_i$  produces the desired result.

22. The relevant calculations can be summarized as follows:

Year	Returns		Return deviations		Squared deviations		Product of deviations
	Security	Market	Security	Market	Security	Market	
1995	12	6	3	2	9	4	6
1996	-9	-12	-18	-16	324	256	288
1997	-6	0	-15	-4	225	16	60
1998	30	-4	21	-8	441	64	-168
1999	18	30	9	26	81	676	234
Totals	45	20	0	0	1,080	1,016	420

	Average returns:	Variances:	Standard deviations:
Security:	$45/5 = 9\%$	$1,080/4 = 270$	$\sqrt{270} = 16.43\%$
Market:	$20/5 = 4\%$	$1,016/4 = 254$	$\sqrt{254} = 15.94\%$

$$\text{Covariance} = \text{Cov}(r_i, r_M) = 420/4 = 105$$

$$\text{Correlation} = \text{Corr}(r_i, r_M) = 105/(16.43 \times 15.94) = .40$$

$$\text{Beta} = \beta = .40 \times (16.43/15.94) = .41$$

Notice that the security's beta is only .41 even though its return was higher over this period. This tells us that the security experienced some unexpected high returns due to positive unsystematic events.

## Chapter 19

### International Finance and Investments

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#### Answers to Questions and Problems

##### Core Questions

1.
  - a. The most recent exchange rate shown is 1730.8215, so \$100 will get you Lit 173,082.
  - b. One lira is worth  $1/1730.8125 = \$0.00058$ .
  - c. You have  $5 \text{ million}/1730.8215 = \$2,888.80$ .
2.
  - a. A New Zealand dollar is worth  $1/1.8442 = \$.542$ . A Singapore dollar is worth  $1/1.7067 = \$.59$ , or a few cents more.
  - b. There are two rates for the Chilean dollar, but both are much larger than the exchange rate for the Mexican peso, so the Mexican peso is worth more.
  - c. The least valuable is the Turkish lira at almost 348,000 per dollar. The most valuable is Kuwaiti dinar at about .3 per dollar.
3.
  - a. £100 is worth about \$163.45 (notice that the UK exchange rate quote is in terms of dollars per pound).
  - b. French francs are quoted at about FF 6. So, 100 francs are worth about \$17, whereas from just above, £100 is worth about \$163.
  - c. From part b., a franc is worth  $\$17/\$163 = .1043$  pounds. A pound is worth  $\$163/\$17 = 9.6$  francs.

4. Interest rate parity requires that:

$$(1 + r(\$))^T = (1 + r(\text{¥}))^T \frac{F_T(\$ / \text{¥})}{S(\$ / \text{¥})}$$

Noting that  $T = 1$  and filling in the other numbers, we get:

$$1.04 = (1 + r(\text{¥})) \times \frac{.0078}{.008}$$

Solving for the Japanese interest rate,  $r(\text{¥})$ , we get  $1.04 \times (.008/.0078) - 1 = 6.67\%$ .

5. If the exchange rate, expressed in won per dollar, rises, your return measured in dollars will be diminished because each won will convert to fewer dollars and vice versa.

6. Suppose the U.S. dollar strengthens relative to the Canadian dollar. This means a U.S. dollar is worth more Canadian dollars. In other words, Canadian dollars become cheaper to buy. If the exchange rate is expressed as Canadian dollars per U.S. dollar, the exchange rate will rise because it takes more Canadian dollars to buy a U.S. dollar.
7. It takes fewer yen to buy a dollar, so the yen has appreciated.
8. The primary benefit is diversification. Because stock markets are not perfectly correlated, there is a theoretical benefit to diversifying among them.
9. Exchange rate changes can amplify or dampen gains and losses from international investing. Unfavorable exchange rate movements can convert gains to losses, and vice versa. As a result, exchange rates may act to increase or decrease risk, depending on the correlation between the exchange rate and market returns. Whether this risk is diversifiable or systematic appears to be an open question.
10. Interest rate parity requires that:

$$(1 + r(\$))^T = (1 + r(\text{DM}))^T \frac{F_T(\$ / \text{DM})}{S(\$ / \text{DM})}$$

Noting that  $T = 1$  and filling in the other numbers, we get:

$$1.05 = 1.04 \times \frac{F(\$ / \text{DM})}{5}$$

Solving for the forward rate, we get  $1.05 \times (.5/1.04) = .505 \$/\text{DM}$ .

### Intermediate Questions

11. The exchange rate for the drachma rose from about 286.5 to about 286.9, so the drachma weakened (it takes more drachma to buy one dollar). The exchange rate for the pound increased from 1.6259 to 1.6345. Remembering that the pound is quoted as dollars per pound, the pound strengthened (it takes more dollars to purchase a pound).
12. The cross rate moved from  $283/(1/1.6705) = 472.75$  drachma per pound to  $287/(1/1.6662) = 478.20$ , so it takes more drachma to buy a pound. The drachma depreciated relative to the pound.



- 13.** There is definitely an arbitrage. The cross rate should be  $6/1.5 = 4$ , or four French francs per Swiss franc. Now, the cross rate is quoted at FF 5 = SF 1, so we want to use Swiss francs to buy French francs because we get 5 instead of 4. So, we first convert \$100 to SF 150. We then convert SF 150 to FF 750 at the quoted cross rate. Finally, we convert FF 750 to \$125. Not bad!

- 14.** Interest rate parity requires that:

$$(1 + r(\$))^T = (1 + r(¥))^T \frac{F_T(\$ / ¥)}{S(\$ / ¥)}$$

Noting that  $T = 90/365$ , or about .25, and filling in the other numbers, we get:

$$1.04^{.25} = (1 + r(¥))^{.25} \times \frac{.0071}{.007}$$

Solving for the Japanese interest rate,  $r(¥)$ , we get  $[1.06^{.25} \times (.007/.00705)]^4 - 1 = 3.02\%$ .

- 15.** Your \$10,000 converts to 1 million won. Your won investment grows to 1.6 million won. When you exchange back to dollars, each won is worth \$.008, so you get \$12,800. Your return was thus 28 percent measured in dollars.
- 16.** Your \$200,000 converts to 8 million francs. Your franc investment grows to 8.8 million francs. When you exchange back to dollars, you get 8.8 million/42 = \$209,523.81. Your return was thus 4.76 percent measured in dollars.
- 17.** If two countries have different inflation rates, then the nominal risk-free rates in the two countries are likely to be different. They may have different real rates as well, but the difference is not likely to be very large.
- 18.** The Canadian rate of inflation is higher, so we expect the Canadian dollar to lose value relative to the U.S. dollar. More precisely, because the inflation differential is 2 percent, the value of a Canadian dollar should decline by 2 percent relative to the U.S. dollar. The exchange rate, which is expressed as U.S. dollars per Canadian dollar should fall because the Canadian dollar will get cheaper.
- 19.** In any diversified portfolio, some sector(s) will typically perform well while others do not. That's precisely why diversification works. As a result, it will almost always turn out that, after the fact, we would have been better off without some of positions. The argument here essentially make the case that investors should only keep after-the-fact "winners" in their portfolios. Such a strategy would lead to a lack of diversification.

20. Many U.S. companies actually derive a majority of their profits from international operations (Coke is a notable example). Investing in such companies provides a very straightforward means of diversifying internationally.