Appendix

Answers to Select Basic Problems

CHAPTER 1

1. (a) Real; (b) executive airplanes; (c) brand names; (d) financial; (e) bonds; (f) investment; (g) capital budgeting; (h) financing.

3. a. Financial assets, such as stocks or bank loans, are claims held by investors. Corporations sell financial assets to raise the cash to invest in real assets such as plant and equipment. Some real assets are intangible.

b. Capital budgeting means investment in real assets. Financing means raising the cash for this investment.

c. The shares of public corporations are traded on stock exchanges and can be purchased by a wide range of investors. The shares of closely held corporations are not traded and are not generally available to investors.

d. Unlimited liability: investors are responsible for all the firm's debts. A sole proprietor has unlimited liability. Investors in corporations have limited liability. They can lose their investment, but no more.

5. *b, c.*

CHAPTER 2

1. \$1.00.

3. $374/(1.09)^9 = \$172$.

5. $100 \times (1.15)^8 = \$305.90$.

7. $PV = 4/(.14 - .04) = \$40$.

9. a. $10{,}000/1.05^5 = \$7{,}840$.

b. You need to set aside (12,000 × 6-year annuity factor) = 12,000 × 4.623 = \$55,476.

c. At the end of 6 years you would have $1.08^6 \times (60{,}476 - 55{,}476) = \$7{,}934$.

11. (a) \$12.625 million; (b) \$12.705 million; (c) \$12.712 million.

CHAPTER 3

1. (a) Does not change; (b) Price falls; (c) Yield rises.

3. The yield over 6 months is 3.965/2 = 1.79825%. Therefore, $PV = 3/1.0179825 + 3/1.0179825^2 + \ldots + 103/1.0179825^{34} = 130.37$.

5. a. Fall (e.g., 1-year 10% bond is worth 110/1.1 = 100 if $r = 10\%$ and is worth 110/1.15 = 95.65 if $r = 15\%$).

b. Less (e.g., see 5a).

c. Less (e.g., with $r = 5\%$, 1-year 10% bond is worth 110/1.05 = 104.76).

d. Higher (e.g., if $r = 10\%$, 1-year 10% bond is worth 110/1.1 = 100, while 1-year 8% bond is worth 108/1.1 = 98.18).

e. No, low-coupon bonds have longer durations (unless there is only one period to maturity) and are therefore more volatile (e.g., if r falls from 10% to 5%, the value of a 2-year 10% bond rises from 100 to 109.3 (a rise of 9.3%). The value of a 2-year 5% bond rises from 91.3 to 100 (a rise of 9.5%).

7. (a) 4%; (b) PV = \$1,075.44.

9. a. $r_1 = 100/99.423 - 1 = .58\%$; $r_2 = (100/97.546)^{.5} - 1 = 1.25\%$; $r_3 = (100/94.510)^{.33} - .1 = 1.90\%$; $r_4 = (100/90.524)^{.25} - 1 = 2.52\%$.

b. Upward-sloping.

c. Lower. (The yield on the bond is a complicated average of the separate spot rates.)

11. a. False. Duration depends on the coupon as well as the maturity.

b. False. Given the yield to maturity, volatility is proportional to duration.

c. True. A lower coupon rate means longer duration and therefore higher volatility.

d. False. A higher interest rate reduces the relative present value of (distant) principal repayments.

13. 7.01%. (The extra return that you earn for investing for 2 years rather than 1 is $1.06^2/1.05 - 1 = .0701$.)

CHAPTER 4

1. (a) True; (b) true.

3. $P_0 = (5 + 110)/1.08 = \$106.48$

5. $P_0 = 10/(.08 - .05) = \$333.33$.

7. 15/.08 + PVGO = 333.33; therefore PVGO = \$145.83.

9. (a) False; (b) true.

11. Free cash flow is the amount of cash thrown off by a business after all investments necessary for growth. In our simple examples, free cash flow equals operating cash flow minus capital expenditure. Free cash flow can be negative if investments are large.

13. If PVGO = 0 at the horizon date H, horizon value = earnings forecasted for $H + 1$ divided by r.

CHAPTER 5

1. (a) A = 3 years, B = 2 years, C = 3 years; (b) B; (c) A, B, and C; (d) B and C (NPV_B = \$3,378; NPV_C = \$2,405); (e) true; (f) It will accept no negative-NPV projects but will turn down some with positive NPVs. A project can have positive NPV if all future cash flows are considered but still do not meet the stated cutoff period.

3. (a) \$15,750; \$4,250; \$0; (b) 100%.

5. (a) Two; (b) − 50% and +50%; (c) yes, NPV = +14.6.

7. 1, 2, 4, and 6.

CHAPTER 6

1. *a, b, d, g, h.*

3. (a) False; (b) false; (c) false; (d) false.

5.

	2010	2011	2012	2013	2014
Working capital	50,000	230,000	305,000	250,000	0
Cash flows	+50,000	+180,000	+75,000	−55,000	−250,000

7. PV cost = 1.5 + .2 × 14.09 = \$4.319 million. Equivalent annual cost = 4.319/14.09 = .306, or \$306,000.

9. Replace at end of 5 years (\$80,000 > \$72,376).

CHAPTER 7

1. Expected payoff is \$100 and expected return is zero. Variance is 20,000 (% squared) and standard deviation is 141%.

3. Ms. Sauros had a slightly higher average return (14.6% vs. 14.4% for the market). However, the fund also had a higher standard deviation (13.6% vs. 9.4% for the market).

5. *d*

7. (a) 26%; (b) zero; (c) .75; (d) less than 1.0 (the portfolio's risk is the same as the market, but some of this risk is unique risk).

9. A, 1.0; B, 2.0; C, 1.5; D, 0; E, − 1.0.

CHAPTER 8

1. (a) 7%; (b) 27% with perfect positive correlation; 1% with perfect negative correlation; 19.1% with no correlation; (c) See Figure 1; (d) No, measure risk by beta, not by standard deviation.

3. Sharpe ratio = 7.1/20.2 = .351.

5. (a) See Figure 2; (b) A, D, G; (c) F; (d) 15% in C. (e) Put 25/32 of your money in F and lend 7/32 at 12%: Expected return = 7/32 × 12 + 25/32 × 18 = 16.7%; standard deviation = 7/32 × 0 + (25/32) × 32 = 25%. If you could borrow without limit, you would achieve as high an expected return as you'd like, with correspondingly high risk, of course.

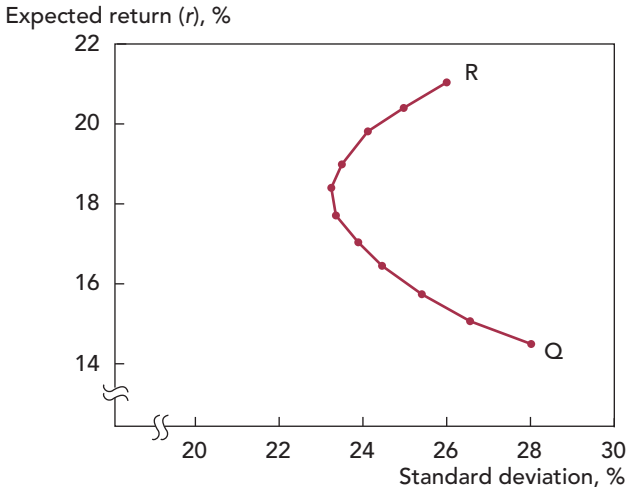


FIGURE 1 Chapter 8, Problem 1(*c*).

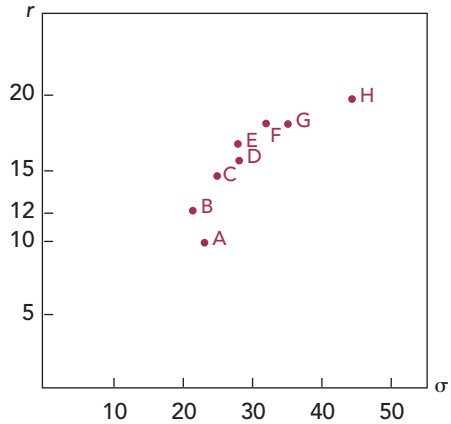


FIGURE 2 Chapter 8, Problem 5(*a*).

7. (a) True; (b) false (it offers twice the market *risk premium*); (c) false.

CHAPTER 9

1. Overestimate.

3. .297, or 29.7% of variation, was due to market movements; .703, or 70.3% of the variation, was diversifiable. Diversifiable risk shows up in the scatter about the fitted line. The standard error of the estimated beta was unusually high at .436. If you said that the true beta was $2 \times .436 = .872$ either side of your estimate, you would have a 95% chance of being right.

5. Beta of assets $= .5 \times .15 + .5 \times 1.25 = .7$.

7. Suppose that the expected cash flow in year 1 is 100, but the project proposer provides an estimate of $100 \times 115/108 = 106.5$. Discounting this figure at 15% gives the same result as discounting the true expected cash flow at 8%. Adjusting the discount rate, therefore, works for the first cash flow but it does not do so for later cash flows (e.g., discounting a 2-year cash flow of 106.5 by 15% is *not* equivalent to discounting a 2-year flow of 100 by 8%).

9. (a) False; (b) false; (c) true.

CHAPTER 10

1. (a) False; (b) true; (c) true.

3. a. Analysis of how project profitability and NPV change if different assumptions are made about sales, cost, and other key variables.

b. Project NPV is recalculated by changing several inputs to new, but consistent, values.

c. Determines the level of future sales at which project profitability or NPV equals zero.

d. An extension of sensitivity analysis that explores all possible outcomes and weights each by its probability.

e. A graphical technique for displaying possible future events and decisions taken in response to those events.

f. Option to modify a project at a future date.

g. The additional present value created by the option to bail out of a project, and recover part of the initial investment, if the project performs poorly.

h. The additional present value created by the option to invest more and expand output, if a project performs well.

5. a. Describe how project cash flow depends on the underlying variables.

b. Specify probability distributions for forecast errors for these cash flows.

c. Draw from the probability distributions to simulate the cash flows.

7. Adding a fudge factor to the discount rate pushes project analysts to submit more optimistic forecasts.

CHAPTER 11

1. (a) False; (b) true; (c) true; (d) false.

3. First consider whether *renting* the building and opening the Taco Palace is positive NPV. Then consider whether to buy (instead of renting) based on your optimistic view of local real estate.

5. The second-hand market value of older planes falls by enough to make up for their higher fuel consumption. Also, the older planes are used on routes where fuel efficiency is relatively less important.

CHAPTER 12

1. (a) True; (b) true; (c) false; (d) true.

3. Monitoring is costly and encounters diminishing returns. Also, completely effective monitoring would require perfect information.

5. ROI $= 1.6/20 = .08$ or 8%. Net return $= 8 - 11.5 = -3.5\%$. EVA $= 1.6 - (.115 \times 20) = -\$.7$ million. EVA is negative.

7. Not usually by creative accounting, but by reducing or delaying discretionary advertising, maintenance, R&D, or other expenses.

CHAPTER 13

1. *c*

3. (a) False; (b) false; (c) true; (d) false; (e) false; (f) true.

5. $6 - (-.2 + 1.45 \times 5) = -1.05\%$.

7. Decrease. The stock price already reflects an expected 25% increase. The 20% increase conveys bad news relative to expectations.

9. a. Evidence that two securities with identical cash flows (e.g., Royal Dutch Shell and Shell Transport & Trading) can sell at different prices.

b. Small-cap stocks and high book-to-market stocks appear to have given above-average returns for their level of risk.

c. IPOs provide relatively low returns after their first few days of trading.

d. Stocks of firms that announce unexpectedly good earnings perform well over the coming months.

In each case there appear to have been opportunities for earning superior profits.

CHAPTER 14

1. (a) False; (b) true; (c) true.

3. a. 80 votes; (b) $10 \times 80 = 800$ votes.

5. a. False; (b) true; (c) false.

CHAPTER 15

1. a. Further sale of an already publicly traded stock;
b. U.S. bond issue by foreign corporation;
c. Bond issue by industrial company;
d. Bond issue by large industrial company.

3. a. Financing of start-up companies.
b. Underwriters gather nonbinding indications of demand for a new issue.
c. The difference between the price at which the underwriter buys the security from the company and resells it to investors.
d. Description of a security offering filed with the SEC.
e. Winning bidders for a new issue tend to overpay.

5. (a) False; (b) false; (c) true.

7. a. Number of new shares, 50,000;
b. Amount of new investment, $500,000;
c. Total value of company after issue, $4,500,000;
d. Total number of shares after issue, 150,000;
e. Stock price after issue, $4,500,000/150,000 = $30;
f. The opportunity to buy one share is worth $20.

CHAPTER 16

1. a. A1, B5; A2, B4; A3, B3; A4, B1; A5, B2;
b. On August 12, the ex-dividend date;
c. $(.35 \times 4)/52 = .027$, or 2.7%;
d. $(.35 \times 4)/4.56 = .31$, or 3.1%;
e. The price would fall to $52/1.10 = \$47.27$.

3. a. Reinvest $1{,}000 \times \$.50 = \$500$ in the stock. If the ex-dividend price is $\$150 - \$2.50$, this should involve the purchase of 500/147.50, or about 3.4 shares.
b. Sell shares worth $1{,}000 \times \$3 = \$3{,}000$. If the ex-dividend price is $\$200 - \$5$, this should involve the sale of 3,000/195, or about 15 shares.

5. a. Company value is unchanged at $5{,}000 \times 140 = \$700{,}000$. Share price stays at $140.
b. The discount rate $r = (DIV_1/P_0) + g = (20/140) + .05 = .193$. The price at which shares are repurchased in year 1 is $140 \times (1 + r) = 140 \times 1.193 = \$167$. Therefore the firm repurchases $50{,}000/167 = 299$ shares. Total dividend payments in year 1 fall to $5{,}000 \times 10 = \$50{,}000$, which is equivalent to $50{,}000/(5000 - 299) = \$10.64$ a share. Similarly, in year 2 the firm repurchases 281 shares at $186.52 and the dividend per share increases by 11.7% to $11.88. In each subsequent year, total dividends increase by 5%, the number of shares declines by 6% and, therefore, dividends per share increase by 11.7%. The constant-growth model gives PV share = $10.64/(.193 - .117) = \$140$.

7. *Current tax law (assuming gains tax cannot be deferred):* All investors should be indifferent except the corporation which prefers Hi.
Zero tax on capital gains: As under the current tax law except that individuals now prefer Lo. (Note: corporations and security dealers treat capital gains as income).

CHAPTER 17

1. Note the market value of Copperhead is far in excess of its book value:

	Market Value
Common stock (8 million shares at $2)	$16,000,000
Short-term loans	$ 2,000,000

Ms. Kraft owns .625% of the firm, which proposes to increase common stock to $17 million and cut short-term debt. Ms. Kraft can offset this by (*a*) borrowing $.00625 \times 1{,}000{,}000 = \$6{,}250$, and (*b*) buying that much more Copperhead stock.

3. Expected return on assets is $r_A = .08 \times 30/80 + .16 \times 50/80 = .13$. The new return on equity will be $r_E = .13 + (20/60)(.13 - .08) = .147$.

5. a. True;
b. True (as long as the return earned by the company is greater than the interest payment, earnings per share increase, but the P/E falls to reflect the higher risk);
c. False (the cost of equity increases with the ratio D/E);
d. False (the formula $r_E = r_A + (D/E)(r_A - r_D)$ does not require r_D to be constant);
e. False (debt amplifies variations in equity income);
f. False (value increases only if clientele is not satisfied).

7. See Figure 17.3.

CHAPTER 18

1. The calculation assumes that the tax rate is fixed, that debt is fixed and perpetual, and that investors' personal tax rates on interest and equity income are the same.

3. $$\text{Relative advantage of debt} = \frac{1 - T_p}{(1 - T_{pE})(1 - T_c)}$$
$$= \frac{.65}{(1)(.65)} = 1.00$$
$$\text{Relative advantage} = \frac{.65}{(.85)(.65)} = 1.18$$

5. a. Direct costs of financial distress are the legal and administrative costs of bankruptcy. Indirect costs include possible delays in liquidation (Eastern Airlines) or poor investment or operating decisions while bankruptcy is being resolved. Also the *threat* of bankruptcy can lead to costs.

b. If financial distress increases odds of default, managers' and shareholders' incentives change. This can lead to poor investment or financing decisions.

c. See the answer to 5(*b*). Examples are the "games" described in Section 18-3.

7. More profitable firms have more taxable income to shield and are less likely to incur the costs of distress. Therefore the trade-off theory predicts high (book) debt ratios. In practice the more profitable companies borrow least.

9. When a company issues securities, outside investors worry that management may have unfavorable information. If so the securities can be overpriced. This worry is much less with debt than equity. Debt securities are safer than equity, and their price is less affected if unfavorable news comes out later.

A company that can borrow (without incurring substantial costs of financial distress) usually does so. An issue of equity would be read as "bad news" by investors, and the new stock could be sold only at a discount to the previous market price.

11. Financial slack is most valuable to growth companies with good but uncertain investment opportunities. Slack means that financing can be raised quickly for positive-NPV investments. But too much financial slack can tempt mature companies to overinvest. Increased borrowing can force such firms to pay out cash to investors.

CHAPTER 19

1. Market values of debt and equity are $D = .9 \times 75 = \$67.5$ million and $E = 42 \times 2.5 = \$105$ million. $D/V = .39$. WACC $= .09(1 - .35).39 + .18(.61) = .1325$, or 13.25%.

3. (a) False; (b) true; (c) true.

5. (a) True; (b) false, if interest tax shields are valued separately; (c) true.

7. a. 12%, of course.

b. $r_E = .12 + (.12 - .075)(30/70) = .139$; WACC $= .075(1 - .35)(.30) + .139(.70) = .112$, or 11.2%.

9. No. The more debt you use, the higher rate of return equity investors will require. (Lenders may demand more also.) Thus there is a hidden cost of the "cheap" debt: it makes equity more expensive.

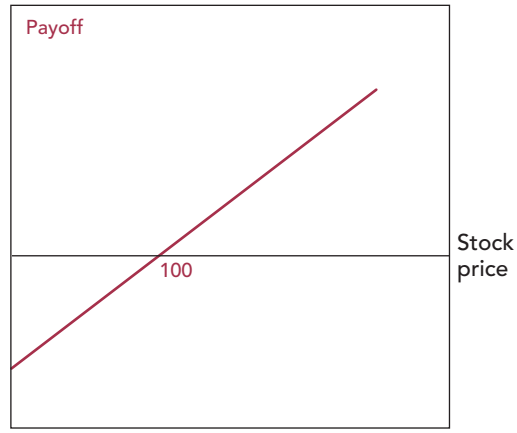


FIGURE 3 Chapter 20, Problem 7.

CHAPTER 20

1. Call; exercise; put; European.

3. a. The exercise price of the put option (i.e., you'd sell stock for the exercise price).

b. The value of the stock (i.e., you would throw away the put and keep the stock).

5. Buy a call and lend the present value of the exercise price.

7. (a) See Figure 3; (b) stock price − PV(EX) = 100 − 100/1.1 = \$9.09.

9. (a) Zero; (b) Stock price less the present value of the exercise price.

11. a. All investors, however risk-averse, should value more highly an option on a volatile stock. For both Exxon Mobil and Google the option is valueless if final stock price is below the exercise price, but the option on Google has more upside potential.

b. Other things equal, stockholders lose and debtholders gain if the company shifts to safer assets. When the assets are risky, the option to default is more valuable. Debtholders bear much of the losses if asset value declines, but shareholders get the gains if asset value increases.

CHAPTER 21

1. a. Using risk-neutral method, $(p \times 20) + (1 - p)(-16.7) = 1$, $p = .48$.

$$\text{Value of call} = \frac{(.48 \times 8) + (.52 \times 0)}{1.01} = 3.8$$

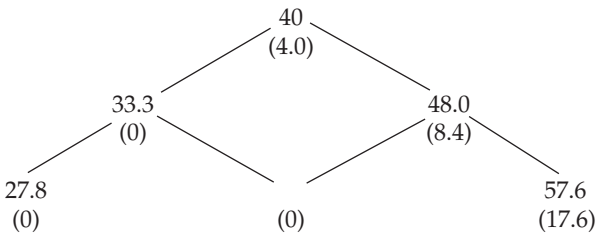
b. $$\text{Delta} = \frac{\text{spread of option prices}}{\text{spread of stock prices}}$$

$$= \frac{8}{14.7} = .544.$$

c.

	Current Cash Flow	Possible Future Cash Flows	
Buy call equals	−3.8	0	+8.0
Buy .544 shares	−21.8	−18.2	+26.2
Borrow 18.0	+18.0	−18.2	−18.2
	−3.8	0	+8.0

d. Possible stock prices with call option prices in parentheses:



Option prices were calculated as follows:

Month 1: (i) $\dfrac{(.48 \times 0) + (.52 \times 0)}{1.01} = 0$

(ii) $\dfrac{(.48 \times 17.6) + (.52 \times 0)}{1.01} = 8.4.$

Month 0: $= \dfrac{(.48 \times 8.4) + (.52 \times 0)}{1.01} = 4.0$

e. Delta $= \dfrac{\text{spread of option prices}}{\text{spread of stock prices}} = \dfrac{8.4}{14.7} = .57$

3. Using the replicating-portfolio method:

a. If month 3 stock price = 350.85, delta = (30 − 0)/(430 − 286.27) = .209
To replicate call, buy .209 shares, and borrow PV(59.752)
Option value = .209 × 350.85 − 59.752/1.0075 = 13.93

b. If month 3 stock price = 527, delta = (245.90 − 30)/(645.90 − 430) = 1
To replicate call, buy 1 share, and borrow PV(527)
Option value = 1 × 527 − 400/1.0075 = 129.98

c. At month 0 delta = (129.98 − 13.93)/(527 − 350.85) = .659
To replicate call, buy .659 shares, and borrow PV(217.29)
Option value = .659 × 430 − 217.29/1.0075 = 67.7
Using the risk-neutral method:
p × .2269 + (1 − p) × .184 = 0.0075: p = .4671

a. If month 3 stock price = 350.85, option value = (.4671 × 30 + .5329 × 0)/1.0075 =13.93

b. If month 3 stock price = 527, option value = (.4671 × 245.90 + .5329 × 30)/1.0075 = 129.99

c. At month 0 option value = (.4671 × 129.99 + .5329 × 13.93)/1.0075 = 67.7

The put option can be valued using put-call parity:
Value of put = 67.7 + 400/1.0075 − 430 = 34.72

5. a. Delta = 100/(200 − 50) = .667.

b.

	Current Cash Flow	Possible Future Cash Flows	
Buy call equals	−36.36	0	+100
Buy .667 shares	−66.67	+33.33	+133.33
Borrow 30.30	+30.30	−33.33	−33.33
	−36.36	0	+100

c. $(p \times 100) + (1 - p)(-50) = 10, p = .4.$

d. Value of call $= \dfrac{(.4 \times 100) + (.6 \times 0)}{1.10} = 36.36.$

e. No. The true probability of a price rise is almost certainly higher than the risk-neutral probability, but it does not help to value the option.

7. True; as the stock price rises, the risk of the option falls.

CHAPTER 22

1. a. Increase value (unless the cash flows from the Mark II needed to be discounted at a higher rate).
b. Increase value.
c. Reduce value.

3. The life of a project is not fixed ahead of time. IM&C has the option to abandon the guano project after 2 or 3 years if performance is poor. If performance is great, exercise of the abandonment option could be delayed well beyond the estimated 7-year life.

5. Gas turbines can be started up on short notice when spark spreads are high. The turbines' value comes from flexibility in production.

7. (a) True; (b) true; (c) true; (d) true; (e) true—the series of smaller plants generates real options, but the large plant may nevertheless be more efficient.

CHAPTER 23

1. Promised yield = 12.72%; expected yield = 9.37%.

3. Put option on company's assets with an exercise price equal to the face value of the bond.

5. The expected growth in the market value of the assets, the face value and maturity of the debt, and the variability of future asset values. (In practice, compromises need to be made if, for example, the company has issued bonds with different maturities.)

7. Both bonds are more likely to be downrated.

CHAPTER 24

1. (a) High-grade utility bonds; (b) industrial holding companies; (c) industrial bonds; (d) railroads; (e) asset-backed security.

3. a. You would like an issue of junior debt.

b. You prefer it not to do so (unless it is also junior debt). The existing property may not be sufficient to pay off your debt.

5. a. Approximately 99.489 + 8.25/12 = 100.18%.

b. .04125 × 250 = $10.3 million on Feb. 15, 1993.

c. After making earlier sinking fund payments, $12.5 million remains to be repaid on Aug. 15,2022.

d. 2008 (but see footnote 20 for some possible complications).

7. a. False. Lenders usually retain some recourse; e.g., they may demand a completion guarantee.

b. True, but some new securities (e.g., eurobonds) survive even when the original motive for issuing them disappears.

c. False. The borrower has the option.

d. True. But debt issues with weak covenants suffered in such takeovers.

e. True. The costs of renegotiation are less for private placements.

9. (a) False; (b) true; (c) false; (d) true.

CHAPTER 25

1. *A, c; B, d* or *i; C, b* or *e; D, f; E, a; F, h; G, g.*

3. a. The lessor must charge enough to cover the present value of the costs of owning and operating the asset over its expected economic life. In a competitive leasing market the present value of rentals cannot exceed the present value of costs. The competitive rental payment ends up equal to the lessor's equivalent annual cost.

b. The user's equivalent annual cost is the annual cost to the user of owning and operating the asset. If the operating lease rate is less than this cost, it pays to lease.

5. If the lease is affirmed, the lessee continues to use the leased asset and must make the full lease payments. If the lease is rejected, the leased asset is returned to the lessor. If the value of the returned asset is not enough to cover the remaining lease payments, the lessor's loss becomes an unsecured claim on the bankrupt firm.

7. Lenders have no claim on the lessor if the lessee defaults. The lessor avoids liability in this case. But lenders will demand better terms, for example, a higher interest rate, as compensation for lack of recourse.

CHAPTER 26

1. a. Price paid for immediate delivery.

b. Forward contracts are contracts to buy or sell at a specified future date at a specified price. Futures differ from forwards in two main ways. They are traded on an exchange and they are marked to market.

c. Investors who are long have agreed to buy the asset. Investors who are short have contracted to sell.

d. The risk that arises because the price of the asset used to hedge is not perfectly correlated with that of the asset that is being hedged.

e. Profits and losses on a position are settled on a regular basis (e.g., daily).

f. The advantage from owning the commodity rather than the promise of future delivery *less* the cost of storing the commodity.

3. She is asking you to pay money, because your sale is showing a loss.

5. Northern Refineries has fixed the price that it will receive for its oil (we ignore possible basis risk). Because it now has a certain income, it gives up the possibility of pleasant surprises as well as unpleasant ones.

7. a. A shortage of heating oil increases net convenience yield and reduces the futures price relative to spot price.

b. Spot and futures prices decrease. The futures price rises relative to spot because convenience yield falls and storage costs rise.

9. (a) Profit;

(b) If the bank took out a new 4-year swap, it would need to pay an extra $.25 million a year. At the new interest rate of 6.5%, the extra payment has a present value of $856,000. This is the amount that the bank should charge to terminate.

11. Sell short $1.2 million of the market portfolio. In practice rather than "sell the market" you would sell futures on $1.2 million of the market index.

CHAPTER 27

1. a. 94.7050;

b. 94.6780;

c. Yen is at a premium (dollar is at a discount);

d. premium = 94.750/94.087 − 1 = .0066, or .66%;

e. From interest rate parity, 94.087/94.750 = $(1 + r_{yen})$/1.015. r_{yen} = .0084 or .84%.

f. 94.6161 yen = $1;

g. If the real exchange rate is expected to be constant, expected difference in inflation is 94.6161/94.7050 − 1 = − .0009, i.e., inflation in Japan over the 3 months is expected to be .09% less than in the United States.

3. a. 2,419 × 1.3/1.02 = R3,083 = $1. b. Real value of rupiah fell by 3,083/8,325 − 1 = .63, or 63%.

5. *b.*

7. It can borrow the present value of €1 million, sell the euros in the spot market, and invest the proceeds in an 8-year dollar loan.

9. a. NPV = 6.61 × 1.2 = $7.94 million.

b.

Year	0	1	2	3	4	5
Forward rate	1.2	1.223	1.246	1.269	1.293	1.318
$ million	−96	12.23	24.91	29.19	34.92	32.94

c. It doesn't. The company can always hedge against a fall in the euro.

CHAPTER 28

1.

$ Thousands		$ Thousands	
Cash	$25	$ 24	Accounts payable
Accounts receivable	35	24	Total current liabilities
Inventories	30	130	Long-term debt
Total current assets	90	76	Equity
Net plant & equipment	140		
Total assets	230	230	Total liabilities & equity

3.

Common-Size Balance Sheet, 2008

	%		%
Cash & marketable securities	8.0	Debt due for repayment	2.4
Accounts receivable	20.6	Accounts payable	31.6
Inventories	19.7	Total current liabilities	33.9
Other current assets	7.2	Long-term debt	21.5
Total current assets	55.6	Other long-term liabilities	11.6
Tangible fixed assets	47.8	Total liabilities	67.0
Less accumulated depreciation	27.0	Total shareholders' equity	33.0
Net tangible fixed assets	20.8		
Long-term investments	.5		
Other long-term assets	23.1		
Total assets	100	Total liabilities & shareholders' equity	100

Common-Size Income Statement, 2008	
Sales	100%
Cost of goods sold	25.2
Selling, general, and administrative expenses	61.3
Depreciation	3.2
Earnings before interest & taxes	10.3
Interest expense	.9
Taxable income	9.4
Tax	3.3
Net income	6.0

5. The illogical ratios are *a, b, c, f,* and *i*. The correct definitions are

$$\text{Debt-equity ratio} = \frac{\text{long-term debt + value of leases}}{\text{equity}}$$

$$\text{Return on equity} = \frac{\text{net income}}{\text{equity at start of year}}$$

$$\text{Payout ratio} = \frac{\text{dividend per share}}{\text{earnings per share}}$$

$$\text{Current ratio} = \frac{\text{current assets}}{\text{current liabilities}}$$

$$\text{Average collection period} = \frac{\text{receivables at start of year}}{\text{daily sales}}$$

7. a. Sales = 3 × 500,000 = 1,500,000; after-tax interest + net income = .08 × 1,500,000 = 120,000; ROA = 120,000/500,000 = 24%;

b. Net income = .08 × 3 × 500,000 − (1 − .35) × 30,000 = 100,500. ROE = net income/equity = 100,500/300,000 = .34.

9. .73.; 3.65%

11. Assume that new debt is a current liability.

a. Current ratio goes from 100/60 = 1.67 to 120/80 = 1.50; cash ratio goes from 30/60 = .5 to 50/80 = .63;

b. Long-term debt ratio is unchanged; total liabilities/total assets goes from 410/600 = .6833 to 430/620 = .6935.

13. $82 million.

CHAPTER 29

1.

	Cash	Working Capital
1.	$2 million decline	$2 million decline
2.	$2,500 increase	Unchanged
3.	$50,000 decline	Unchanged
4.	Unchanged	$10 million increase
5.	Unchanged	Unchanged
6.	$5 million increase	Unchanged

3. Month 3: 18 + (.5 × 90) + (.3 × 120) + (.2 × 100) = $119,000.

Month 4: 14 + (.5 × 70) + (.3 × 90) + (.2 × 120) = $100,000.

5. a. Table 29.2: Cash = 40, Total current assets = 340; Bank loans = 15; Current liabilities = 150; and Total assets = Total liabilities and net worth = 590.

Table 29.3: Increase (decrease) in short-term debt = −10; net cash flow from financing activities = −35; Increase in cash balance = 20.

b. Table 29.2: Long-term debt = 130; Gross investment = 375; Net fixed assets = 275; Cash = 40; Current assets = 340; and Total assets = Total liabilities and net worth = 615.

Table 29.3: Increase (decrease) in long-term debt = 30 + 40 =70; Net cash flow from financing activities = −50 + 40= −10; Investment in fixed assets = −(25 + 30) = −55; Increase in cash balance = 20.

c. Table 29.1: Operating cost (cost of goods sold + other expenses) = (1,644 + 411) × .9 = 1,850; Pretax income = 2,200 − 1,850 − 20 − 5 = 325; Net income = 325 × .5 = 162.5. If dividend is unchanged, earnings retained in the business = 162.5 − 30 = 132.5.

Table 29.2: assuming inventories are unchanged, Cash = 25 +132.5 − 30 = 127.5; Current assets =427.5; Net worth = 452.5; total assets = total liabilities and net worth = 677.5.

Table 29.3: Net income = 162.5; Net cash flow from operating activities = 85 + 102.5 =187.5; Increase (decrease) in cash balance = 107.5

d. Table 29.4 changes as follows:

	Q3	Q4
Receivables at start	181.6	105.2
Sales	742	836
Collections:		
Current sales	667.8	752.4
Last period sales	150.6	74.2
Total collections	818.4	826.6
Receivables at end	105.2	114.6

Table 29.5 changes as follows:

	Q3	Q4
Collections on accounts receivable	818.4	826.6
Total sources	895.4	826.6
Sources minus uses	268.4	189.1
Cash at start	−188.6	79.8
Change in cash balance	268.4	189.1
Cash at end	79.8	268.9
Cumulative financing required	−54.8	243.9

e. Table 29.5 changes as follows:

	Q1	Q2	Q3	Q4
Labor and other expenses	116	116	116	116
Total sources	531	539.4	767	827.8
Sources minus uses	121	−52.6	140	190.3
Short-term borrowing requirement:				
Cash at start	25	−96	−148.6	−8.6
Change in cash balance	−121	−52.6	140	190.3
Cash at end	−96	−148.6	−8.6	181.7
Cumulative financing required	121	173.6	33.6	−156.7

f. Table 29.5 changes as follows:

	Q2	Q3	Q4
Other	50	77	
Total sources	569.4	747	807.8
Sources minus uses	−22.6	120	170.3
Short-term borrowing requirement:			
Cash at start	−116	−138.6	−18.6
Change in cash balance	−22.6	120	170.3
Cash at end	−138.6	−18.6	151.7
Cumulative financing required	163.6	43.6	−126.7

g. Table 29.5 changes as follows:

	Q1	Q2	Q3	Q4
Minimum operating balance	10	10	10	10
Cumulative financing required	126	198.6	78.6	−91.7

7. (a) $ 2,900,000; (b) $ 225,000; (c) .25.
9. (a) 8.6%; (b) 13.75%.

CHAPTER 30

1. By holding large inventories, the firm avoids the risk of running out of materials and finished goods. It can order materials in larger quantities and arrange longer production runs. On the other hand, inventories tie up capital, must be stored and insured, and may be subject to damage.

Similarly, large cash inventories reduce the risk of running out of cash or having to sell securities at short notice. The firm needs to make less frequent sales of securities and therefore minimize the fixed costs of such sales. On the other hand, inventories of cash tie up capital.

3. a. Due lag decreases, therefore pay lag decreases.
b. Due lag increases, therefore pay lag increases.
c. Terms lag increases, therefore pay lag increases.

5. a. Expected profit $= p(1{,}200 - 1{,}050) - 1{,}050\,(1 - p) = 0$

$$p = .875$$

Therefore, grant credit if probability of payment exceeds 87.5%.

b. Expected profit from selling to slow payer: $.8(150) - .2(1{,}050) = -90$. Break-even point for credit check: $(.05 \times 90 \times \text{units}) - 12 = 0$. Units = 2.67.

7. (a) False; (b) false; (c) false—should be collection agency or attorney.

9. a. The $.40 per check fee is cheaper at $300 \times .40 = \$120$ per day. The cost of putting up $800,000 of compensating balances is $.09 \times 800{,}000 = \$72{,}000$ per year, or 72,000/365 = $197 per day.

b. The lockbox system costs $120 per day, or $43,800 per year. You would need $486,700 additional cash to generate this much interest. Thus the lockbox system must generate at least this much cash. The cash flow is $300 \times 1{,}500 = \$450{,}000$ per day. Thus the lockbox must speed up average collection time by 486,700/450,000 = 1.08 days.

11. (a) Less; (b) less; (c) invest the same amount; (d) more.

13. (a) Repurchase agreements; (b) commercial paper; (c) finance company commercial paper; (d) 3-month bills; (e) Treasury bills; (f) Treasury bills.

15. (a) True; (b) false (borrower has a call); (c) true; (d) false (100/90 − 1 = .111, or 11.1%); (e) true.

CHAPTER 31

1. (a) Horizontal; (b) conglomerate; (c) vertical; (d) conglomerate.

3. (a) $5 million (We assume that the $500,000 saving is an after-tax figure.); (b) $4 million; (c) $7.5 million; (d) +$1 million; (e) − $2.5 million.

5. (a) True; (b) false; (c) false; (d) true; (e) false (They may produce gains, but "large" is stretching it.); (f) false; (g) true.

CHAPTER 32

1. a. Purchase of a business using mostly debt financing. The company goes private. Management is given a substantial equity stake.
b. An LBO undertaken by management.
c. A parent company creates a new company with part of its assets and operations. Shares in the new business are distributed to the parent's stockholders.
d. Like a spin-off, but shares in the new business are sold to investors.
e. Sale of specific assets rather than entire firm.
f. A government-owned business is sold to private investors.
g. A company moves to a much higher debt ratio. Proceeds of additional borrowing are paid out to stockholders.

3. Increased efficiency, broader share ownership, and revenue for the government.

5. Internal capital markets often misallocate capital. The market values of the conglomerate's divisions can't be observed separately, so it's hard to set incentives and to reward risk-taking.

7. Chapter 7 usually leads to liquidation. Chapter 11 protects the firm from its creditors while a reorganization plan is developed.

9. There is always a chance that the company can recover, allowing creditors to be paid off and leaving something for shareholders. Also, the court may not observe *absolute priority,* so shareholders may be given some crumbs in a Chapter 11 reorganization.

CHAPTER 33

1. (a) USA and UK; (b) USA; (c) Japan and Europe; (d) Japan; (e) UK; (f) Japan. (*Note:* Answers exclude countries not separately shown in Figures 33.1–33.4.)

3. No. Individual investors hold relatively little common stock directly. Also the cross-holdings of stock by Japanese companies limit the opportunities for individuals to play an important role in governance.

5. German firms have two boards of directors: a management board and a supervisory board, half of whose members are elected by employees. The supervisory board represents the interests of the company as a whole, not just the interests of employees or stockholders.

7. The shareholder has a .3 holding in x_2. x_2 has a .3 holding in x, which has a .3 holding in z. The shareholder really has only a $.3^3$ or .027 holding in z.

9. If firm y has a large stake in x, it may be able to transfer value from x by borrowing from x at a low interest rate, selling materials to x at excessive prices, or buying x's output at low prices.

Present Value Tables

APPENDIX TABLE 1

Discount factors: Present value of $1 to be received after t years $= 1/(1 + r)^t$.

Number of Years	Interest Rate per Year														
	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%
1	.990	.980	.971	.962	.952	.943	.935	.926	.917	.909	.901	.893	.885	.877	.870
2	.980	.961	.943	.925	.907	.890	.873	.857	.842	.826	.812	.797	.783	.769	.756
3	.971	.942	.915	.889	.864	.840	.816	.794	.772	.751	.731	.712	.693	.675	.658
4	.961	.924	.888	.855	.823	.792	.763	.735	.708	.683	.659	.636	.613	.592	.572
5	.951	.906	.863	.822	.784	.747	.713	.681	.650	.621	.593	.567	.543	.519	.497
6	.942	.888	.837	.790	.746	.705	.666	.630	.596	.564	.535	.507	.480	.456	.432
7	.933	.871	.813	.760	.711	.665	.623	.583	.547	.513	.482	.452	.425	.400	.376
8	.923	.853	.789	.731	.677	.627	.582	.540	.502	.467	.434	.404	.376	.351	.327
9	.914	.837	.766	.703	.645	.592	.544	.500	.460	.424	.391	.361	.333	.308	.284
10	.905	.820	.744	.676	.614	.558	.508	.463	.422	.386	.352	.322	.295	.270	.247
11	.896	.804	.722	.650	.585	.527	.475	.429	.388	.350	.317	.287	.261	.237	.215
12	.887	.788	.701	.625	.557	.497	.444	.397	.356	.319	.286	.257	.231	.208	.187
13	.879	.773	.681	.601	.530	.469	.415	.368	.326	.290	.258	.229	.204	.182	.163
14	.870	.758	.661	.577	.505	.442	.388	.340	.299	.263	.232	.205	.181	.160	.141
15	.861	.743	.642	.555	.481	.417	.362	.315	.275	.239	.209	.183	.160	.140	.123
16	.853	.728	.623	.534	.458	.394	.339	.292	.252	.218	.188	.163	.141	.123	.107
17	.844	.714	.605	.513	.436	.371	.317	.270	.231	.198	.170	.146	.125	.108	.093
18	.836	.700	.587	.494	.416	.350	.296	.250	.212	.180	.153	.130	.111	.095	.081
19	.828	.686	.570	.475	.396	.331	.277	.232	.194	.164	.138	.116	.098	.083	.070
20	.820	.673	.554	.456	.377	.312	.258	.215	.178	.149	.124	.104	.087	.073	.061

Number of Years	Interest Rate per Year														
	16%	17%	18%	19%	20%	21%	22%	23%	24%	25%	26%	27%	28%	29%	30%
1	.862	.855	.847	.840	.833	.826	.820	.813	.806	.800	.794	.787	.781	.775	.769
2	.743	.731	.718	.706	.694	.683	.672	.661	.650	.640	.630	.620	.610	.601	.592
3	.641	.624	.609	.593	.579	.564	.551	.537	.524	.512	.500	.488	.477	.466	.455
4	.552	.534	.516	.499	.482	.467	.451	.437	.423	.410	.397	.384	.373	.361	.350
5	.476	.456	.437	.419	.402	.386	.370	.355	.341	.328	.315	.303	.291	.280	.269
6	.410	.390	.370	.352	.335	.319	.303	.289	.275	.262	.250	.238	.227	.217	.207
7	.354	.333	.314	.296	.279	.263	.249	.235	.222	.210	.198	.188	.178	.168	.159
8	.305	.285	.266	.249	.233	.218	.204	.191	.179	.168	.157	.148	.139	.130	.123
9	.263	.243	.225	.209	.194	.180	.167	.155	.144	.134	.125	.116	.108	.101	.094
10	.227	.208	.191	.176	.162	.149	.137	.126	.116	.107	.099	.092	.085	.078	.073
11	.195	.178	.162	.148	.135	.123	.112	.103	.094	.086	.079	.072	.066	.061	.056
12	.168	.152	.137	.124	.112	.102	.092	.083	.076	.069	.062	.057	.052	.047	.043
13	.145	.130	.116	.104	.093	.084	.075	.068	.061	.055	.050	.045	.040	.037	.033
14	.125	.111	.099	.088	.078	.069	.062	.055	.049	.044	.039	.035	.032	.028	.025
15	.108	.095	.084	.074	.065	.057	.051	.045	.040	.035	.031	.028	.025	.022	.020
16	.093	.081	.071	.062	.054	.047	.042	.036	.032	.028	.025	.022	.019	.017	.015
17	.080	.069	.060	.052	.045	.039	.034	.030	.026	.023	.020	.017	.015	.013	.012
18	.069	.059	.051	.044	.038	.032	.028	.024	.021	.018	.016	.014	.012	.010	.009
19	.060	.051	.043	.037	.031	.027	.023	.020	.017	.014	.012	.011	.009	.008	.007
20	.051	.043	.037	.031	.026	.022	.019	.016	.014	.012	.010	.008	.007	.006	.005

Note: For example, if the interest rate is 10% per year, the present value of $1 received at year 5 is $.621.

APPENDIX TABLE 2

Future value of $1 after t years $= (1 + r)^t$.

Number of Years	Interest Rate per Year														
	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%
1	1.010	1.020	1.030	1.040	1.050	1.060	1.070	1.080	1.090	1.100	1.110	1.120	1.130	1.140	1.150
2	1.020	1.040	1.061	1.082	1.102	1.124	1.145	1.166	1.188	1.210	1.232	1.254	1.277	1.300	1.323
3	1.030	1.061	1.093	1.125	1.158	1.191	1.225	1.260	1.295	1.331	1.368	1.405	1.443	1.482	1.521
4	1.041	1.082	1.126	1.170	1.216	1.262	1.311	1.360	1.412	1.464	1.518	1.574	1.630	1.689	1.749
5	1.051	1.104	1.159	1.217	1.276	1.338	1.403	1.469	1.539	1.611	1.685	1.762	1.842	1.925	2.011
6	1.062	1.126	1.194	1.265	1.340	1.419	1.501	1.587	1.677	1.772	1.870	1.974	2.082	2.195	2.313
7	1.072	1.149	1.230	1.316	1.407	1.504	1.606	1.714	1.828	1.949	2.076	2.211	2.353	2.502	2.660
8	1.083	1.172	1.267	1.369	1.477	1.594	1.718	1.851	1.993	2.144	2.305	2.476	2.658	2.853	3.059
9	1.094	1.195	1.305	1.423	1.551	1.689	1.838	1.999	2.172	2.358	2.558	2.773	3.004	3.252	3.518
10	1.105	1.219	1.344	1.480	1.629	1.791	1.967	2.159	2.367	2.594	2.839	3.106	3.395	3.707	4.046
11	1.116	1.243	1.384	1.539	1.710	1.898	2.105	2.332	2.580	2.853	3.152	3.479	3.836	4.226	4.652
12	1.127	1.268	1.426	1.601	1.796	2.012	2.252	2.518	2.813	3.138	3.498	3.896	4.335	4.818	5.350
13	1.138	1.294	1.469	1.665	1.886	2.133	2.410	2.720	3.066	3.452	3.883	4.363	4.898	5.492	6.153
14	1.149	1.319	1.513	1.732	1.980	2.261	2.579	2.937	3.342	3.797	4.310	4.887	5.535	6.261	7.076
15	1.161	1.346	1.558	1.801	2.079	2.397	2.759	3.172	3.642	4.177	4.785	5.474	6.254	7.138	8.137
16	1.173	1.373	1.605	1.873	2.183	2.540	2.952	3.426	3.970	4.595	5.311	6.130	7.067	8.137	9.358
17	1.184	1.400	1.653	1.948	2.292	2.693	3.159	3.700	4.328	5.054	5.895	6.866	7.986	9.276	10.76
18	1.196	1.428	1.702	2.026	2.407	2.854	3.380	3.996	4.717	5.560	6.544	7.690	9.024	10.58	12.38
19	1.208	1.457	1.754	2.107	2.527	3.026	3.617	4.316	5.142	6.116	7.263	8.613	10.20	12.06	14.23
20	1.220	1.486	1.806	2.191	2.653	3.207	3.870	4.661	5.604	6.727	8.062	9.646	11.52	13.74	16.37

Number of Years	Interest Rate per Year														
	16%	17%	18%	19%	20%	21%	22%	23%	24%	25%	26%	27%	28%	29%	30%
1	1.160	1.170	1.180	1.190	1.200	1.210	1.220	1.230	1.240	1.250	1.260	1.270	1.280	1.290	1.300
2	1.346	1.369	1.392	1.416	1.440	1.464	1.488	1.513	1.538	1.563	1.588	1.613	1.638	1.664	1.690
3	1.561	1.602	1.643	1.685	1.728	1.772	1.816	1.861	1.907	1.953	2.000	2.048	2.097	2.147	2.197
4	1.811	1.874	1.939	2.005	2.074	2.144	2.215	2.289	2.364	2.441	2.520	2.601	2.684	2.769	2.856
5	2.100	2.192	2.288	2.386	2.488	2.594	2.703	2.815	2.932	3.052	3.176	3.304	3.436	3.572	3.713
6	2.436	2.565	2.700	2.840	2.986	3.138	3.297	3.463	3.635	3.815	4.002	4.196	4.398	4.608	4.827
7	2.826	3.001	3.185	3.379	3.583	3.797	4.023	4.259	4.508	4.768	5.042	5.329	5.629	5.945	6.275
8	3.278	3.511	3.759	4.021	4.300	4.595	4.908	5.239	5.590	5.960	6.353	6.768	7.206	7.669	8.157
9	3.803	4.108	4.435	4.785	5.160	5.560	5.987	6.444	6.931	7.451	8.005	8.595	9.223	9.893	10.60
10	4.411	4.807	5.234	5.695	6.192	6.728	7.305	7.926	8.594	9.313	10.09	10.92	11.81	12.76	13.79
11	5.117	5.624	6.176	6.777	7.430	8.140	8.912	9.749	10.66	11.64	12.71	13.86	15.11	16.46	17.92
12	5.936	6.580	7.288	8.064	8.916	9.850	10.87	11.99	13.21	14.55	16.01	17.61	19.34	21.24	23.30
13	6.886	7.699	8.599	9.596	10.70	11.92	13.26	14.75	16.39	18.19	20.18	22.36	24.76	27.39	30.29
14	7.988	9.007	10.15	11.42	12.84	14.42	16.18	18.14	20.32	22.74	25.42	28.40	31.69	35.34	39.37
15	9.266	10.54	11.97	13.59	15.41	17.45	19.74	22.31	25.20	28.42	32.03	36.06	40.56	45.59	51.19
16	10.75	12.33	14.13	16.17	18.49	21.11	24.09	27.45	31.24	35.53	40.36	45.80	51.92	58.81	66.54
17	12.47	14.43	16.67	19.24	22.19	25.55	29.38	33.76	38.74	44.41	50.85	58.17	66.46	75.86	86.50
18	14.46	16.88	19.67	22.90	26.62	30.91	35.85	41.52	48.04	55.51	64.07	73.87	85.07	97.86	112.5
19	16.78	19.75	23.21	27.25	31.95	37.40	43.74	51.07	59.57	69.39	80.73	93.81	108.9	126.2	146.2
20	19.46	23.11	27.39	32.43	38.34	45.26	53.36	62.82	73.86	86.74	101.7	119.1	139.4	162.9	190.0

Note: For example, if the interest rate is 10% per year, the investment of $1 today will be worth $1.611 at year 5.

APPENDIX TABLE 3

Annuity table: Present value of $1 per year for each of t years $= 1/r - 1/[r(1 + r)^t]$.

Number of Years	Interest Rate per Year														
	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%
1	.990	.980	.971	.962	.952	.943	.935	.926	.917	.909	.901	.893	.885	.877	.870
2	1.970	1.942	1.913	1.886	1.859	1.833	1.808	1.783	1.759	1.736	1.713	1.690	1.668	1.647	1.626
3	2.941	2.884	2.829	2.775	2.723	2.673	2.624	2.577	2.531	2.487	2.444	2.402	2.361	2.322	2.283
4	3.902	3.808	3.717	3.630	3.546	3.465	3.387	3.312	3.240	3.170	3.102	3.037	2.974	2.914	2.855
5	4.853	4.713	4.580	4.452	4.329	4.212	4.100	3.993	3.890	3.791	3.696	3.605	3.517	3.433	3.352
6	5.795	5.601	5.417	5.242	5.076	4.917	4.767	4.623	4.486	4.355	4.231	4.111	3.998	3.889	3.784
7	6.728	6.472	6.230	6.002	5.786	5.582	5.389	5.206	5.033	4.868	4.712	4.564	4.423	4.288	4.160
8	7.652	7.325	7.020	6.733	6.463	6.210	5.971	5.747	5.535	5.335	5.146	4.968	4.799	4.639	4.487
9	8.566	8.162	7.786	7.435	7.108	6.802	6.515	6.247	5.995	5.759	5.537	5.328	5.132	4.946	4.772
10	9.471	8.983	8.530	8.111	7.722	7.360	7.024	6.710	6.418	6.145	5.889	5.650	5.426	5.216	5.019
11	10.37	9.787	9.253	8.760	8.306	7.887	7.499	7.139	6.805	6.495	6.207	5.938	5.687	5.453	5.234
12	11.26	10.58	9.954	9.385	8.863	8.384	7.943	7.536	7.161	6.814	6.492	6.194	5.918	5.660	5.421
13	12.13	11.35	10.63	9.986	9.394	8.853	8.358	7.904	7.487	7.103	6.750	6.424	6.122	5.842	5.583
14	13.00	12.11	11.30	10.56	9.899	9.295	8.745	8.244	7.786	7.367	6.982	6.628	6.302	6.002	5.724
15	13.87	12.85	11.94	11.12	10.38	9.712	9.108	8.559	8.061	7.606	7.191	6.811	6.462	6.142	5.847
16	14.72	13.58	12.56	11.65	10.84	10.11	9.447	8.851	8.313	7.824	7.379	6.974	6.604	6.265	5.954
17	15.56	14.29	13.17	12.17	11.27	10.48	9.763	9.122	8.544	8.022	7.549	7.120	6.729	6.373	6.047
18	16.40	14.99	13.75	12.66	11.69	10.83	10.06	9.372	8.756	8.201	7.702	7.250	6.840	6.467	6.128
19	17.23	15.68	14.32	13.13	12.09	11.16	10.34	9.604	8.950	8.365	7.839	7.366	6.938	6.550	6.198
20	18.05	16.35	14.88	13.59	12.46	11.47	10.59	9.818	9.129	8.514	7.963	7.469	7.025	6.623	6.259

Number of Years	Interest Rate per Year														
	16%	17%	18%	19%	20%	21%	22%	23%	24%	25%	26%	27%	28%	29%	30%
1	.862	.855	.847	.840	.833	.826	.820	.813	.806	.800	.794	.787	.781	.775	.769
2	1.605	1.585	1.566	1.547	1.528	1.509	1.492	1.474	1.457	1.440	1.424	1.407	1.392	1.376	1.361
3	2.246	2.210	2.174	2.140	2.106	2.074	2.042	2.011	1.981	1.952	1.923	1.896	1.868	1.842	1.816
4	2.798	2.743	2.690	2.639	2.589	2.540	2.494	2.448	2.404	2.362	2.320	2.280	2.241	2.203	2.166
5	3.274	3.199	3.127	3.058	2.991	2.926	2.864	2.803	2.745	2.689	2.635	2.583	2.532	2.483	2.436
6	3.685	3.589	3.498	3.410	3.326	3.245	3.167	3.092	3.020	2.951	2.885	2.821	2.759	2.700	2.643
7	4.039	3.922	3.812	3.706	3.605	3.508	3.416	3.327	3.242	3.161	3.083	3.009	2.937	2.868	2.802
8	4.344	4.207	4.078	3.954	3.837	3.726	3.619	3.518	3.421	3.329	3.241	3.156	3.076	2.999	2.925
9	4.607	4.451	4.303	4.163	4.031	3.905	3.786	3.673	3.566	3.463	3.366	3.273	3.184	3.100	3.019
10	4.833	4.659	4.494	4.339	4.192	4.054	3.923	3.799	3.682	3.571	3.465	3.364	3.269	3.178	3.092
11	5.029	4.836	4.656	4.486	4.327	4.177	4.035	3.902	3.776	3.656	3.543	3.437	3.335	3.239	3.147
12	5.197	4.988	4.793	4.611	4.439	4.278	4.127	3.985	3.851	3.725	3.606	3.493	3.387	3.286	3.190
13	5.342	5.118	4.910	4.715	4.533	4.362	4.203	4.053	3.912	3.780	3.656	3.538	3.427	3.322	3.223
14	5.468	5.229	5.008	4.802	4.611	4.432	4.265	4.108	3.962	3.824	3.695	3.573	3.459	3.351	3.249
15	5.575	5.324	5.092	4.876	4.675	4.489	4.315	4.153	4.001	3.859	3.726	3.601	3.483	3.373	3.268
16	5.668	5.405	5.162	4.938	4.730	4.536	4.357	4.189	4.033	3.887	3.751	3.623	3.503	3.390	3.283
17	5.749	5.475	5.222	4.990	4.775	4.576	4.391	4.219	4.059	3.910	3.771	3.640	3.518	3.403	3.295
18	5.818	5.534	5.273	5.033	4.812	4.608	4.419	4.243	4.080	3.928	3.786	3.654	3.529	3.413	3.304
19	5.877	5.584	5.316	5.070	4.843	4.635	4.442	4.263	4.097	3.942	3.799	3.664	3.539	3.421	3.311
20	5.929	5.628	5.353	5.101	4.870	4.657	4.460	4.279	4.110	3.954	3.808	3.673	3.546	3.427	3.316

Note: For example, if the interest rate is 10% per year, the investment of $1 received in each of the next 5 years is $3.791.

APPENDIX TABLE 4

Values of e^{rt}. Future value of $1 invested at a *continuously compounded* rate r for t years.

rt	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.00	1.000	1.010	1.020	1.030	1.041	1.051	1.062	1.073	1.083	1.094
.10	1.105	1.116	1.127	1.139	1.150	1.162	1.174	1.185	1.197	1.209
.20	1.221	1.234	1.246	1.259	1.271	1.284	1.297	1.310	1.323	1.336
.30	1.350	1.363	1.377	1.391	1.405	1.419	1.433	1.448	1.462	1.477
.40	1.492	1.507	1.522	1.537	1.553	1.568	1.584	1.600	1.616	1.632
.50	1.649	1.665	1.682	1.699	1.716	1.733	1.751	1.768	1.786	1.804
.60	1.822	1.840	1.859	1.878	1.896	1.916	1.935	1.954	1.974	1.994
.70	2.014	2.034	2.054	2.075	2.096	2.117	2.138	2.160	2.181	2.203
.80	2.226	2.248	2.271	2.293	2.316	2.340	2.363	2.387	2.411	2.435
.90	2.460	2.484	2.509	2.535	2.560	2.586	2.612	2.638	2.664	2.691
1.00	2.718	2.746	2.773	2.801	2.829	2.858	2.886	2.915	2.945	2.974
1.10	3.004	3.034	3.065	3.096	3.127	3.158	3.190	3.222	3.254	3.287
1.20	3.320	3.353	3.387	3.421	3.456	3.490	3.525	3.561	3.597	3.633
1.30	3.669	3.706	3.743	3.781	3.819	3.857	3.896	3.935	3.975	4.015
1.40	4.055	4.096	4.137	4.179	4.221	4.263	4.306	4.349	4.393	4.437
1.50	4.482	4.527	4.572	4.618	4.665	4.711	4.759	4.807	4.855	4.904
1.60	4.953	5.003	5.053	5.104	5.155	5.207	5.259	5.312	5.366	5.419
1.70	5.474	5.529	5.585	5.641	5.697	5.755	5.812	5.871	5.930	5.989
1.80	6.050	6.110	6.172	6.234	6.297	6.360	6.424	6.488	6.553	6.619
1.90	6.686	6.753	6.821	6.890	6.959	7.029	7.099	7.171	7.243	7.316
2.00	7.389	7.463	7.538	7.614	7.691	7.768	7.846	7.925	8.004	8.085
2.10	8.166	8.248	8.331	8.415	8.499	8.585	8.671	8.758	8.846	8.935
2.20	9.025	9.116	9.207	9.300	9.393	9.488	9.583	9.679	9.777	9.875
2.30	9.974	10.07	10.18	10.28	10.38	10.49	10.59	10.70	10.80	10.91
2.40	11.02	11.13	11.25	11.36	11.47	11.59	11.70	11.82	11.94	12.06
2.50	12.18	12.30	12.43	12.55	12.68	12.81	12.94	13.07	13.20	13.33
2.60	13.46	13.60	13.74	13.87	14.01	14.15	14.30	14.44	14.59	14.73
2.70	14.88	15.03	15.18	15.33	15.49	15.64	15.80	15.96	16.12	16.28
2.80	16.44	16.61	16.78	16.95	17.12	17.29	17.46	17.64	17.81	17.99
2.90	18.17	18.36	18.54	18.73	18.92	19.11	19.30	19.49	19.69	19.89
3.00	20.09	20.29	20.49	20.70	20.91	21.12	21.33	21.54	21.76	21.98
3.10	22.20	22.42	22.65	22.87	23.10	23.34	23.57	23.81	24.05	24.29
3.20	24.53	24.78	25.03	25.28	25.53	25.79	26.05	26.31	26.58	26.84
3.30	27.11	27.39	27.66	27.94	28.22	28.50	28.79	29.08	29.37	29.67
3.40	29.96	30.27	30.57	30.88	31.19	31.50	31.82	32.14	32.46	32.79
3.50	33.12	33.45	33.78	34.12	34.47	34.81	35.16	35.52	35.87	36.23
3.60	36.60	36.97	37.34	37.71	38.09	38.47	38.86	39.25	39.65	40.04
3.70	40.45	40.85	41.26	41.68	42.10	42.52	42.95	43.38	43.82	44.26
3.80	44.70	45.15	45.60	46.06	46.53	46.99	47.47	47.94	48.42	48.91
3.90	49.40	49.90	50.40	50.91	51.42	51.94	52.46	52.98	53.52	54.05

Note: For example, if the continuously compounded interest rate is 10% per year, the investment of $1 today will be worth $1.105 at year 1 and $1.221 at year 2.

APPENDIX TABLE 5

Present value of $1 per year received in a continuous stream for each of t years (discounted at an *annually compounded* rate r) $= \{1 - 1/(1 + r)^t\}/\{\ln(1 + r)\}$.

Number of Years	Interest Rate per Year														
	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%
1	.995	.990	.985	.981	.976	.971	.967	.962	.958	.954	.950	.945	.941	.937	.933
2	1.980	1.961	1.942	1.924	1.906	1.888	1.871	1.854	1.837	1.821	1.805	1.790	1.774	1.759	1.745
3	2.956	2.913	2.871	2.830	2.791	2.752	2.715	2.679	2.644	2.609	2.576	2.543	2.512	2.481	2.450
4	3.922	3.846	3.773	3.702	3.634	3.568	3.504	3.443	3.383	3.326	3.270	3.216	3.164	3.113	3.064
5	4.878	4.760	4.648	4.540	4.437	4.337	4.242	4.150	4.062	3.977	3.896	3.817	3.741	3.668	3.598
6	5.825	5.657	5.498	5.346	5.202	5.063	4.931	4.805	4.685	4.570	4.459	4.353	4.252	4.155	4.062
7	6.762	6.536	6.323	6.121	5.930	5.748	5.576	5.412	5.256	5.108	4.967	4.832	4.704	4.582	4.465
8	7.690	7.398	7.124	6.867	6.623	6.394	6.178	5.974	5.780	5.597	5.424	5.260	5.104	4.956	4.816
9	8.609	8.243	7.902	7.583	7.284	7.004	6.741	6.494	6.261	6.042	5.836	5.642	5.458	5.285	5.121
10	9.519	9.072	8.657	8.272	7.913	7.579	7.267	6.975	6.702	6.447	6.208	5.983	5.772	5.573	5.386
11	10.42	9.884	9.391	8.935	8.512	8.121	7.758	7.421	7.107	6.815	6.542	6.287	6.049	5.826	5.617
12	11.31	10.68	10.10	9.572	9.083	8.633	8.218	7.834	7.478	7.149	6.843	6.559	6.294	6.048	5.818
13	12.19	11.46	10.79	10.18	9.627	9.116	8.647	8.216	7.819	7.453	7.115	6.802	6.512	6.242	5.992
14	13.07	12.23	11.46	10.77	10.14	9.571	9.048	8.570	8.131	7.729	7.359	7.018	6.704	6.413	6.144
15	13.93	12.98	12.12	11.34	10.64	10.00	9.423	8.897	8.418	7.980	7.579	7.212	6.874	6.563	6.276
16	14.79	13.71	12.75	11.88	11.11	10.41	9.774	9.201	8.681	8.209	7.778	7.385	7.024	6.694	6.390
17	15.64	14.43	13.36	12.41	11.55	10.79	10.10	9.482	8.923	8.416	7.957	7.539	7.158	6.809	6.490
18	16.48	15.14	13.96	12.91	11.98	11.15	10.41	9.742	9.144	8.605	8.118	7.676	7.275	6.910	6.577
19	17.31	15.83	14.54	13.39	12.39	11.49	10.69	9.983	9.347	8.777	8.263	7.799	7.380	6.999	6.652
20	18.14	16.51	15.10	13.86	12.77	11.81	10.96	10.21	9.533	8.932	8.394	7.909	7.472	7.077	6.718

Number of Years	Interest Rate per Year														
	16%	17%	18%	19%	20%	21%	22%	23%	24%	25%	26%	27%	28%	29%	30%
1	.929	.925	.922	.918	.914	.910	.907	.903	.900	.896	.893	.889	.886	.883	.880
2	1.730	1.716	1.703	1.689	1.676	1.663	1.650	1.638	1.625	1.613	1.601	1.590	1.578	1.567	1.556
3	2.421	2.392	2.365	2.337	2.311	2.285	2.259	2.235	2.211	2.187	2.164	2.141	2.119	2.098	2.077
4	3.016	2.970	2.925	2.882	2.840	2.799	2.759	2.720	2.682	2.646	2.610	2.576	2.542	2.509	2.477
5	3.530	3.464	3.401	3.340	3.281	3.223	3.168	3.115	3.063	3.013	2.964	2.917	2.872	2.828	2.785
6	3.972	3.886	3.804	3.724	3.648	3.574	3.504	3.436	3.370	3.307	3.246	3.187	3.130	3.075	3.022
7	4.354	4.247	4.145	4.048	3.954	3.865	3.779	3.696	3.617	3.542	3.469	3.399	3.331	3.266	3.204
8	4.682	4.555	4.434	4.319	4.209	4.104	4.004	3.909	3.817	3.730	3.646	3.566	3.489	3.415	3.344
9	4.966	4.819	4.680	4.547	4.422	4.302	4.189	4.081	3.978	3.880	3.786	3.697	3.612	3.530	3.452
10	5.210	5.044	4.887	4.739	4.599	4.466	4.340	4.221	4.108	4.000	3.898	3.801	3.708	3.619	3.535
11	5.421	5.237	5.063	4.900	4.747	4.602	4.465	4.335	4.213	4.096	3.986	3.882	3.783	3.689	3.599
12	5.603	5.401	5.213	5.036	4.870	4.713	4.566	4.428	4.297	4.173	4.057	3.946	3.841	3.742	3.648
13	5.759	5.542	5.339	5.150	4.972	4.806	4.650	4.503	4.365	4.235	4.112	3.997	3.887	3.784	3.686
14	5.894	5.662	5.446	5.245	5.058	4.882	4.718	4.564	4.420	4.284	4.157	4.036	3.923	3.816	3.715
15	6.010	5.765	5.537	5.326	5.129	4.945	4.774	4.614	4.464	4.324	4.192	4.068	3.951	3.841	3.737
16	6.111	5.853	5.614	5.393	5.188	4.998	4.820	4.655	4.500	4.355	4.220	4.092	3.973	3.860	3.754
17	6.197	5.928	5.679	5.450	5.238	5.041	4.858	4.687	4.529	4.381	4.242	4.112	3.990	3.875	3.767
18	6.272	5.992	5.735	5.498	5.279	5.076	4.889	4.714	4.552	4.401	4.259	4.127	4.003	3.887	3.778
19	6.336	6.047	5.781	5.538	5.313	5.106	4.914	4.736	4.571	4.417	4.273	4.139	4.014	3.896	3.785
20	6.391	6.094	5.821	5.571	5.342	5.130	4.935	4.754	4.586	4.430	4.284	4.149	4.022	3.903	3.791

Note: For example, if the interest rate is 10% per year, a continuous cash flow of $1 a year for each of 5 years is worth $3.977. A continuous flow of $1 in year 5 only is worth $3.977 − $3.326 = $.651.

APPENDIX TABLE 6

Cumulative probability [$N(d)$] that a normally distributed variable will be less than d standard deviations above the mean.

d	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
0.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
0.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
0.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
0.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952

Note: For example, if $d = .22$, $N(d) = .5871$ (i.e., there is a .5871 probability that a normally distributed variable will be less than .22 standard deviations above the mean).