

Extra Problems (From Textbook)

1. “The cost of capital always depends on the risk of the project being evaluated. Therefore company costs of capital are useless.” Is that correct? Evaluate the statement.

2. a) Nero Violins has the following capital Structure:

Security	Beta	Total Market Value, Millions of Dollars
Debt	0	100
Preferred stock	.20	40
Common stock	1.20	200

- What is the firm’s asset beta (i.e., the beta of a portfolio of all the firm’s securities)?
- How would the asset beta change if Nero issued an additional \$140 million of common stock and used the cash to repurchase all the debt and preferred stock?
- Assume that the capital asset pricing model is correct. What discount rate should Nero set for investments that expand the scale of its operations without changing its asset beta? Assume any new investment is all equity-financed, the risk-free rate is 3% and the market risk premium is 8.4%.

3. Amalgamated Products has three operating divisions:

Division	Percentage of Firm Value
Food	50
Electronics	30
Chemicals	20

To estimate the cost of capital for each division, Amalgamated has identified the following three principal competitors:

	Estimated Equity Beta	Debt/(Debt + Equity)
United Foods	.8	.3
General Electronics	1.6	.2
Associated Chemicals	1.2	.4

Assume these Betas are accurate estimates and that the capital asset pricing model is correct.

- Assuming that the debt of these firms is risk-free, estimate the asset beta for each of Amalgamated's divisions.
- Amalgamated's ratio of debt to debt plus equity is .4. If your estimates of divisional betas are right, what is Amalgamated's equity beta?
- Assume that the risk-free interest rate is 7 percent and that the expected return on the market index is 15 percent. Estimate the cost of capital for each of Amalgamated's divisions.
- How much would your estimates of each division's cost of capital change if you assumed that debt has a beta of .2?

4. The financial statements of Eagle Sport Supply are shown in the table below. For simplicity, “Costs” include interest. Assume that Eagle’s assets are proportional to its sales.
- Find Eagle’s required external funds if it maintains a dividend payout ratio of 60 percent and plans a growth rate of 15 percent in 1997.
 - If Eagle chooses not to issue new shares of stock, what variable must be the balancing item? What will its value be?
 - Now suppose that the firm plans instead to increase long-term debt only to \$1100 and does not wish to issue any new shares of stock. Why must the dividend payment now be the balancing item? What will its value be?

1996 financial statements for Eagle Sport Supply

Income Statement	
Sales	\$950
Costs	\$250
EBIT	\$700
Taxes	\$200
Net Income	\$500

Balance Sheet, Year-End					
	1995	1996		1995	1996
Assets	\$2,700	\$3,000	Debt	\$ 900	\$1,000
			Equity	1,800	2,000
Total	\$2,700	\$3000	Total	\$2,700	\$3,000

5. Go Go Industries is growing at 30 percent per year. It is all-equity-financed and has total assets of \$1 million. Its return on equity is 20 percent. Its plow-back ratio is 40 percent.
- What is the internal growth rate?
 - What is the firm’s need for external financing this year?
 - By how much would the firm increase its internal growth rate if it reduced its payout ratio to zero?

- d) By how much would such a move reduce the need for external financing? What do you conclude about the relationship between dividend policy and requirements for external financing?
6. Which *one* of the following statements is correct?
- a) Value of put + present value of exercise price = value of call + share price
 - b) Value of put + share price = value of call + present value of exercise price
 - c) Value of put – share price = present value of exercise price – value of call
 - d) Value of put + value of call = share price – present value of exercise price
- The correct statement equates the value of two investment strategies. Plot the payoffs to each strategy as a function of the stock price. Show that the two strategies give identical payoffs.
7. The common stock of Triangular File Company is selling at \$90. A 26-week call option written on Triangular File's stock is selling for \$8. The call's exercise price is \$100. The risk-free interest rate is 10 percent per year.
- a) Suppose that puts on Triangular are not traded, but you want to buy one. How would you do it?
 - b) Suppose that puts *are* traded. What should a 26-week put with an exercise price of \$100 sell for?

8. Describe each of the following situations in the language of options:

a) Drilling rights to undeveloped heavy crude oil in southern California. Development and production of the oil now is a negative-NPV endeavor. (The break-even oil price is \$32 per barrel, versus a spot price of \$20.) However, the decision to develop can be put off for up to 5 years. Development costs are expected to increase by 5 percent per year.

b) A restaurant is producing net cash flows, after all out-of-pocket expenses, of \$700,000 per year. There is no upward or downward trend in the cash flows, but they fluctuate, with an annual standard deviation of 15 percent. The real estate occupied by the restaurant is owned, not leased, and could be sold for \$5 million. Ignore taxes.

c) A variation on part b): Assume the restaurant faces known fixed costs of \$300,000 per year, incurred as long as the restaurant is operating. Thus

$$\begin{aligned}\text{Net cash flow} &= \text{revenue less variable costs} - \text{fixed costs} \\ \$700,000 &= 1,000,000 - 300,000\end{aligned}$$

The annual standard deviation of the forecast error of revenue less variable costs is 10.5 percent. The interest rate is 10 percent. Ignore taxes.

d) The British-French treaty giving a concession to build a railroad link under the English Channel also requires the concessionaire to propose by the year 2000 to build a “drive-through link” if “technical and economic conditions permit... and the increase in traffic shall justify it without undermining the expected return on the first [rail] link.” Other companies will not be permitted to build a link before the year 2020.

9. Options have many uses. They allow you a) to take a levered position in the asset, b) to sell the asset short, c) to ensure against a fall in the value of the asset, d) to hedge against any changes in the asset value, and e) to bet on the asset’s variability. Explain *how* you can use options in each of these ways. Are there other means to achieve the same ends?

10. Respond to the following comment: “It’s all very well saying that I can sell shares to cover cash needs, but that may mean selling at the bottom of the market. If the company pays a regular dividend, investors avoid that risk.”

11. Hors d'Age Cheeseworks has been paying a regular dividend of \$4 per share each year for over a decade. The company is paying out all its earnings as dividends and is not expected to grow. There are 100,000 shares outstanding, selling for \$80 per share. The company has sufficient cash on hand to pay the next annual dividend.

Suppose that Hors d'Age decides to cut its cash dividend to zero and announces that it will repurchase shares instead.

- a) What is the immediate stock price reaction? Ignore taxes, and assume that the repurchase program conveys no information about operating profitability or business risk.
- b) How many shares will Hors d'Age purchase?
- c) Project and compare future stock prices for the old and new policies. Do this for at least years 1, 2, and 3.

Answers to Extra Textbook Problems

1. It is true that the cost of capital depends on the risk of the project being evaluated. However, if the risk of the project is similar to the risk of the other assets of the company, then the appropriate rate of return is just the company cost of capital. If, on the other hand, the new assets are different from the firm's existing assets, then the company cost of capital is inappropriate. In this case, it would be better to use the cost of capital from a firm with assets similar to those of the project.

$$2. \quad a. \quad \beta_{asset} = \frac{(0 \cdot 100) + (.2 \cdot 40) + (1.2 \cdot 200)}{100 + 40 + 200} = .73$$

b. A change in the capital structure does not affect the risk of the assets, and so β_{asset} will remain the same.

c. Using the Security Market Line, $r_{asset} = r_f + \beta_{asset}(R.P.)$, and assuming $r_f = 3\%$ and $R.P. = 8.4\%$, $r_{asset} = .03 + .73 (.084)$
 $r_{asset} = .091$, or 9.1% .

3. a. Because the debt is risk-free, $\beta_{Debt} = 0$. This implies that:

$$\beta_{asset} = \frac{E}{D+E} \beta_{Equity} + \frac{D}{D+E} \beta_{Debt} = \frac{E}{D+E} \beta_{Equity}$$

Therefore,

$$\beta_{food} = .7(.8) = .56$$

$$\beta_{elec} = .8(1.6) = 1.28$$

$$\beta_{chem} = .6(1.2) = .72$$

$$b. \quad \beta_{asset} = .5(.56) + .3(1.28) + .2(.72)$$

$$\beta_{asset} = .81$$

Still assuming risk-free debt,

$$\beta_{asset} = (E/V) \beta_{equity}$$

$$.81 = .6 \beta_{equity}$$

$$\beta_{equity} = 1.35$$

c. Using the Security Market Line,

$$r_{asset} = r_f + \beta_{asset}(r_m - r_f)$$

we have

$$r_{food} = .07 + .56(.15 - .07) = .115, \text{ or } 11.5\%$$

$$r_{elec} = .07 + 1.28(.15 - .07) = .172, \text{ or } 17.2\%$$

$$r_{chem} = .07 + .72(.15 - .07) = .128, \text{ or } 12.8\%$$

d. With risky debt,

$$\beta_{\text{food}} = .3(.2) + .7(.8) = .62 \text{ and } r_{\text{food}} = 12.0\%$$

$$\beta_{\text{elec}} = .2(.2) + .8(1.6) = 1.32 \text{ and } r_{\text{elec}} = 17.6\%$$

$$\beta_{\text{chem}} = .4(.2) + .6(1.2) = .80 \text{ and } r_{\text{chem}} = 13.4\%$$

4. a. With a growth rate of 15%, total assets will grow to \$3450. The income statement (assuming constant ratios) will be:

Sales	1092.5
Costs	287.5
EBIT	805.0
Taxes	<u>230.0</u>
Net Income	<u>575.0</u>

Keeping the payout ratio at 60% implies that a \$345 ($.6 \times 575$) dividend will be paid. Thus, retained earnings will increase by \$230 ($=575-345$) and the equity value will be \$2230. In order for total assets to equal liabilities plus equity, debt must be \$1220 ($=\$3450-\2230). This represents an increase of \$220 over the previous level of debt. Therefore, \$220 of external funds will be needed.

b. From above, debt will increase to \$1220.

c. With no new shares of stock, and the debt increase limited to \$100, the firm will have to retain an additional \$120 of earnings ($=\$220-\100). Therefore, the dividend payment will be \$225 ($\$345 - \120).

5. a. Internal growth rate = retained earnings/assets

$$\text{Internal growth rate} = \frac{.20(1,000,000)(.40)}{1,000,000}$$

$$\text{Internal growth rate} = 8.0\%$$

b. The need for external financing is equal to the increase in assets less the retained earnings:

$$.30(1,000,000) - .20(1,000,000)(.40) = \$220,000$$

c. With no dividends, the plowback ratio becomes one and

$$\text{Internal growth rate} = \frac{.20(1,000,000)(1.0)}{1,000,000}$$

$$\text{Internal growth rate} = 20\%$$

d. Retained earnings will now be \$200,000 and the need for external funds reduced to \$100,000. Clearly, the more generous the dividend policy (i.e., the higher the payout ratio), the greater the need for external financing.

6. Statement (b) is the only correct one - this is put/call parity.
7. a. Use the fundamental relationship for European options:
 Value of call + PV of exercise price = Value of put + Share price.
 Solve for the value of the put:
 Value of put = Value of call + PV of exercise option - Share price.
 Thus, to replicate a put, you would buy a call with an exercise price of \$100 and the same maturity, invest the present value of the exercise price in a 26-week risk-free security, and sell the stock short.
- b. Using the above relationship, we know that the European put will sell for:
 $8 + (100/1.05) - 90 = \$13.24$
 (Note that an American put will sell for slightly more.)
8. a. A five-year American call option on oil. The initial exercise price is \$32 a barrel, but the exercise price rises by 5 percent per year.
- b. An American put option to abandon the restaurant at an exercise price of \$5 million. The restaurant's current value is \$700,000/r. The annual standard deviation of the changes in the value of the restaurant as a going concern is 15%.
- c. A put option as in (b), except that the exercise price should be interpreted as \$5 million in real estate value plus the present value of the future fixed costs avoided by closing down the restaurant. Thus, the exercise price is $5,000,000 + (300,000/.10) = \$8,000,000$. Note: the underlying asset is now PV(revenue-variable cost), with annual standard deviation of 10.5%.
- d. The phrase "if technical and economic conditions permit" and the suggestion that supply can be expanded without affecting price are somewhat obscure. However, Eurotunnel has an option to make a follow-on investment, which expires in the year 2020. At that point, other companies may be permitted to build the drive-through link, and their costs will determine the prices that could be charged by Eurotunnel.
9. a. From put-call parity, $P - PV(EX) = PV(\text{call}) - PV(\text{put})$. In other words, "buy call, sell put" is equivalent to "buy share on borrowed money." Also, over any short period, buying a call is equivalent to a levered position in the stock.
- b. You can replicate a short position in the asset by buying a put, selling a call, and lending the balance. Where short-selling is infeasible (and no futures are traded), options may be the only way to sell short.
- c. Buy the asset and buy a put. The put places a floor on the value of your investment. Sometimes you may be able to purchase puts to provide this kind of

insurance. If not, it may be possible to replicate the insurance by a dynamic strategy of selling the asset and placing the proceeds in a deposit account.

d. From put-call parity, you can remove all risk by holding the asset, buying the put and selling the call. Alternatively, you can hedge an asset by a dynamic combination of the stock and put options. This may not be the only way to get rid of risk. You may sell it and put the proceeds in the bank, or you may be able to hold the asset and simultaneously sell a futures contract.

e. To profit from a market underestimate of volatility, buy a straddle; i.e., buy a call and a put with the same exercise price. To profit from a market overestimate of volatility, buy a butterfly; i.e., buy two calls with different exercise prices and sell two calls with an exercise price mid-way between. Options are generally the only way to bet on an asset's variability.

10. The risk stems from the decision to not invest and not from the form of financing. If an investor consumes the dividend instead of re-investing it in the company, she is also "selling" a part of her stake in the company, and will suffer an equal opportunity loss if the price subsequently rises sharply.

11. a. If we ignore taxes and there is no information conveyed by the repurchase, when the share repurchase plan is announced there will be no change in share price: it will remain at \$80.

b. The regular dividend has been \$4 per share, and so the company has \$400,000 cash on hand. With a share price of \$80, it will repurchase 5,000 shares.

c. Total asset value (before each dividend or repurchase) remains at \$8,000,000, and these assets earn \$400,000 per year, under either policy.

Old Policy: The annual dividend is \$4 and it never changes, so the stock price (just before the dividend payment) will be \$80 for all years.

New Policy: Every year \$400,000 is available for share repurchase. As noted above, at $t=0$, 5,000 shares will be repurchased. At $t=1$, then, just before the repurchase there will be 95,000 shares outstanding, and these shares will be worth \$8,000,000, or \$84.21 per share. With \$400,000 available to repurchase shares, the total number repurchased will be 4,750. We can thus generate the following table:

<u>Time</u>	<u>Shares Outstanding</u>	<u>Share Price</u>	<u>Shares Repurchased</u>
$t=0$	100,000	\$80.00	5,000
$t=1$	95,000	\$84.21	4,750
$t=2$	90,250	\$88.64	4,513
$t=3$	85,737	\$93.31	4,287

Note that the stock price is increasing by 5.26% each year. This is consistent with the rate of return to the shareholders under the old policy, whereby every year assets worth \$7,600,000 (the asset value just after the dividend) earn \$400,000, or a return of 5.26%.