FM 2555A
Solutions to Chapter 8 – Practice Exercises

Problem [1/454]

Ms Kraft owns 50,000 shares of the common stock of Copperhead Corporation with a market value of $2 per share, or $100,000 overall. The company is currently financed as follows:

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

Coperhead now announces that it is replacing $1 million of short-term debt with an issue of common stock. What action can Ms Kraft take to ensure that she is entitled to exactly the same proportion of profits as before?

SOLUTION:

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

Ownership percent = shares owned / total shares
Ownership percent = 50,000 / 8m
Ownership percent = .00625, or .625%

Borrow = ownership percent × firm's debt reduction
Borrow = .625% × $1m
Borrow = $6,250

Ms. Kraft owns .625% of the firm, which proposes to increase common stock to $17 million and cut short-term debt by $1 million. Ms. Kraft can offset the firm's change in capital structure by borrowing $6,250 and buying that much more Copperhead stock.

Problem [2/454]

Spam Corp is financed entirely by common stock and has beta of 1.0. The firm is expected to generate a level, perpetual stream of earnings and dividends. The stock has a price-earnings ratio of 8 and a cost of equity of 12.5%. The company's stock is selling for $50. Now the firm decides to repurchase half of its shares and substitute an equal value of debt. The debit is risk-free, with a 5% interest rate. The company is exempt from corporate income taxes. Assuming MM are correct, calculate the following items after the refinancing:
    a. The cost of equity
    b. The overall cost of capital (WACC)

c. The price-earnings ratio
d. The stock price
e. The stock's beta

SOLUTION:

a. Given a 12.5 percent cost of equity before debt we find the expected return on equity:

$$r_A = r_D(D / V) + r_E(E / V)$$
$$.125 = .05(.50) + r_E(.50)$$
$$r_E = .20, \text{ or } 20\%$$

b. The overall cost of capital will remain unchanged at 12.5 percent.

c. Maintaining the perpetual stream of earnings and dividends, the E/P must now be 20 percent, which implies a P/E ratio of 5.

d. Assuming MM are correct, the stock price remains at $50.

e. Since the debt is risk free, its beta is zero; the beta of the stock is found as:

$$\beta_A = \beta_D(D / V) + \beta_E(E / V)$$
$$1.0 = .0(.50) + \beta_E(.50)$$
$$\beta_E = 2.0$$

Problem [3/454]

The common stock and debt of Northern Sludge are valued at $50 million and $30 million, respectively. Investors currently require a16% return on the common stock and an 8% return on the debt. If Northern Sludge issues an additional $10 million of common stocks and uses this money to retire debt, what happens to the expected return on the stock? Assume that the change in capital structure does not affect the risk of the debt and there are no taxes.

SOLUTION:

Assuming the company's risk of debt is not affected and there are no taxes, the expected return on assets will not change. The expected return on assets is:

$$r_A = r_D(D / V) + r_E(E / V)$$
$$r_A = .08(30 / 80) + .16(50 / 80)$$
$$r_A = .13, \text{ or } 13\%$$

Holding r_A constant, the new return on equity will be:

$r_A = r_D(D / V) + r_E(E / V)$
$.13 = .08(20 / 80) + r_E (60 / 80)$
$r_E = .1467$, or 14.67%

Problem [4/455]

Suppose that Macbeth Spot Removers issues $2,500 of debt and uses the proceeds ti repurchase 250 shares.

    a. Illustrate how earnings per share and share return vary with operating income.

    b. If the beta of Macbeth's asset is 0.8 and its debt is risk-free, what would be the beta of the equity after the debt issue?

SOLUTION:

    a. Share price = $10; Shares outstanding = 750

Operating income ($)	500	1,000	1,500	2,000
Interest ($)	250	250	250	250
Equity earnings ($)	250	750	1,250	1,750
Earnings per share ($)	.33	1.00	1.67	2.33
Return on shares (%)	3.33	10.00	16.67	23.33

    b.   New capital structure:

    Debt = $2,500

    Equity = $10,000 – 2,500
    Equity = $7,500

    D/E = .33

    $\beta_A = \beta_D(D / V) + \beta_E(E / V)$
    $.8 = .0($2,500 / $10,000) + \beta_E($7,500 / $10,000)$
    $\beta_E = 1.07$

Problem [6/455]

Suppose that Ms Macbeth's investment bankers have informed her that since the new issue of debt is risky, debtholders will demand a return of 12.5%, which is 2.5% above the risk-free interest rate.

    a. What are r_A and r_E?

    b. Suppose that the beta of the unlevered stock was 0.6. What will be β_A, β_E, and β_D after the change to the capital structure?

SOLUTION:

a. Debt = $5,000

Equity = $10,000 − 5,000
Equity = $5,000

Total = $10,000

The return on assets will remain constant at 15 percent.

$r_A = r_D(D / V) + r_E(E / V)$
$.15 = .125(.50) + r_E(.50)$
$r_E = .1750$, or 17.50%

b. The beta of the assets is unchanged; $\beta_A = .6$.

$\beta_A = \beta_D(D / V) + \beta_E(E / V)$
$.6 = .50\beta_D + .50\beta_E$

To solve for two unknowns, you need two formulae:

The second formula requires the risk-free rate, which is:

Risk-free rate = 12.5% − 2.5
Risk-free rate = 10%

We know the risk premium per unit of beta must be constant, therefore:

Risk premium$_D$ / β_D = Risk premium$_E$ / β_E
$(.125 − .100) / \beta_D = (.175 − .100) / \beta_E$
$\beta_E = 3\beta_D$

Substituting back into our original formula we have:

$.6 = .50\beta_D + .50(3\beta_D)$
$\beta_D = .3$

Given the value of β_D:

$\beta_E = 3\beta_D$
$\beta_E = 3(.3)$
$\beta_E = .9$

Problem [8/455]

Gaucho Services starts life with all-equity financing and a cost of equity of 14%. Suppose it refinances to the following market-value capital structure:

Debt (D)	45%	at $r_D = 9.5\%$
Equity (E)	55%	

Use MM's proposition 2 to calculate the new cost of equity. Gaucho pays taxes at a marginal rate $T_C = 40\%$. Calculate Gaucho's after-tax WACC.

SOLUTION:

$r_E = r_A + (r_A - r_D)(D/E)$
$r_E = .14 + (.14 - .095) \times (45 / 55)$
$r_E = .1768$, or 17.68%

After-tax WACC $= r_D(1 - T_c)(D/V) + r_E(D/E)$
After-tax WACC $= .095 \times (1 - .40) \times .45 + .1768 \times .55$
After-tax WACC $= .1229$, or 12.29%

Problem [9/456]

Companies A and B differ only in their capital structure. A is financed 30% debt and 70% equity; B is financed 10% debt and 90% equity. The debt of both companies is risk-free.

a. Rosencrantz owns 1% of the common stock of A. What other investment package would produce identical cash flows for Rosencratz?

b. Guildenstern own 2% of the common stock of B. What other investment package would produce identical cash flows for Guildenstern?

c. Show that neither Rosencrantz nor Guildenstern would invest in the common stock of B if the *total* value of company A were less than that of B.

SOLUTION:

a. The two firms have equal value; let V represent the total value of the firm. Rosencrantz could buy 1% of Company B's equity and borrow an amount equal to:

$$0.01 \times (D_A - D_B) = 0.002\,V$$

This investment requires a net cash outlay of $(0.007\,V)$ and provides a net cash return of:

$$(0.01 \times \text{profits}) - (0.003 \times r_f \times V)$$

where r_f is the risk-free rate of interest on debt. Thus, the two investments are identical.

b.   Guildenstern could buy 2% of Company A's equity and lend an amount equal to:

$$0.02 \times (D_A - D_B) = 0.004\,V$$

This investment requires a net cash outlay of (0.018 V) and provides a net cash return of:

$$(0.02 \times \text{profits}) - (0.002 \times r_f \times V)$$

Thus the two investments are identical.

c.   The expected dollar return to Rosencrantz' original investment in A is:

$$(0.01 \times C) - (0.003 \times r_f \times V_A)$$

where C is the expected profit (cash flow) generated by the firm's assets. Since the firms are the same except for capital structure, C must also be the expected cash flow for Firm B. The dollar return to Rosencrantz' alternative strategy is:

$$(0.01 \times C) - (0.003 \times r_f \times V_B)$$

Also, the cost of the original strategy is (0.007 V_A) while the cost of the alternative strategy is (0.007 V_B).

If V_A is less than V_B, then the original strategy of investing in Company A would provide a larger dollar return at the same time that it would cost less than the alternative. Thus, no rational investor would invest in Company B if the value of Company A were less than that of Company B.

Problem [11/456]

Executive Chalk is financed solely by common stock and has outstanding 25 million shares with a market price of $10 a share. It now announces that it intends to issue $160 million of debt and to use the proceeds to buy back common stocks.
  a. How is the market price of the stock affected by the announcement?
  b. How many shares can the company buy back with the $160 million of new debt that it issues?
  c. What is the debt ratio after the change in structure?
  d. Who (if anyone) gain or loses?

SOLUTION:

   a.   The market price of the stock is not affected by the announcement.

   b.   Shares repurchased = repurchase amount / share price

           Shares repurchased = $160m / $10

           Shares repurchased = 16 million

c.   Market value = debt + equity

        Market value = $160m + [(25m − 16m) × $10]

        Market value = $250 million

        The market value of the firm is unchanged.

d.   Debt ratio = debt / (debt + equity)

        Debt ratio = $160m / $250m

        Debt ratio = .64

e.   No one gains or loses.

Problem [13/456]

Hubbard's Pet Foods is financed 80% by common stock and 20% by bonds. The expected return on the common stock is 12% and the rate of interest on the bonds is 6%. Assuming the bonds are default-risk free, draw a graph that shows the expected return of Hubbard's common stock (r_E) and the expected return on the package of common stock and bonds (r_A) for different debt-equity ratios.
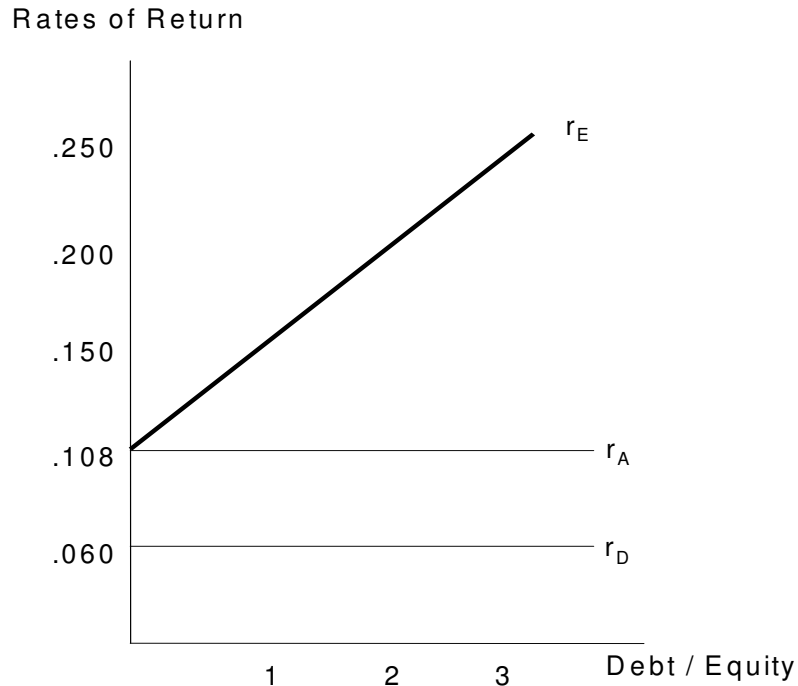
SOLUTION:

The company cost of capital is:

$$r_A = (0.8 \times 0.12) + (0.2 \times 0.06) = 0.108 = 10.8\%$$

Under Proposition I, this is unaffected by capital structure changes. With the bonds remaining at the 6% default–risk free rate, we have:

Debt-Equity Ratio	r_E	r_A
0.00	0.108	0.108
0.10	0.113	0.108
0.50	0.132	0.108
1.00	0.156	0.108
2.00	0.204	0.108
3.00	0.252	0.108

See figure below:

Rates of Return

Problem [19/457]

Archimedes Levers is financed by a mixture of debt and equity. You have the following information about its cost of capital:

$r_E =$ _____	$r_D = 12\%$	$r_A =$ _____
$\beta_E = 1.5$	$\beta_D =$ _____	$\beta_A =$ _____
$r_f = 10\%$	$r_m = 18\%$	D/V = 0.5

Can you fill in the blanks?

SOLUTION:

We begin with r_E and the capital asset pricing model:

$r_E = r_f + \beta_E(r_m - r_f)$

$r_E = .10 + 1.5(.18 - .10)$

$r_E = .2200$, or 22.00%

Similarly for debt:

$r_D = r_f + \beta_D(r_m - r_f)$

$.12 = .10 + \beta_D(.18 - .10)$

$\beta_D = .25$

Also, we know that:

$r_A = r_D(D / V) + r_E(E / V)$
$r_A = .12(.50) + .22(.50)$
$r_E = .1700$, or 17.00%

Lastly, solving for β_A:

$\beta_A = \beta_D(D / V) + \beta_E(E / V)$
$\beta_A = .25(.50) + 1.5(.50)$
$\beta_A = .88$

Problem [20/457]
Look back at Problem [19/457]. Suppose now that Archimedes repurchases debt and issues equity so that D/V = 0.3. The reduced borrowing causes r_D to fall to 11%. How do the other variables change?
SOLUTION:
We know from Proposition I that the value of the firm will not change. Also, since the expected operating income is unaffected by changes in leverage, the firm's overall cost of capital will not change. In other words, r_A remains equal to 17% and β_A remains equal to 0.875. However, risk and, hence, the expected return for equity and for debt, will change. We know that r_D is 11%, so that, for debt:

$r_D = r_f + \beta_D (r_m - r_f)$

$0.11 = 0.10 + \beta_D (0.18 - 0.10)$

$\beta_D = 0.125$

For equity:

$$r_A = \left(\frac{D}{D + E} \times r_D \right) + \left(\frac{E}{D + E} \times r_E \right)$$

$0.17 = (0.3 \times 0.11) + (0.7 \times r_E)$

$r_E = 0.196 = 19.6\%$

Also:

$r_E = r_f + \beta_E (r_m - r_f)$

$0.196 = 0.10 + \beta_E (0.18 - 0.10)$

$\beta_E = 1.20$