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**Problem Set: Leverage and Capital Structure**

**(Solutions Below)**

**Leverage**

1. Money, Inc., has no debt outstanding and a total market value of $150,000. Earnings before interest and taxes, EBIT, are projected to be $14,000 if economic conditions are normal. If there is strong expansion in the economy, then EBIT will be 30 percent higher. If there is a recession, then EBIT will be 60 percent lower. Money is considering a $60,000 debt issue with a 5 percent interest rate. The proceeds will be used to repurchase shares of stock. There are currently 2,500 shares outstanding. The company has a market-to-book ratio of 1.0. Ignore taxes for parts a and b.
	1. Calculate return on equity, ROE, under each of the three economic scenarios before any debt is issued. Also, calculate the percentage changes in ROE for economic expansion and recession, assuming no taxes.
	2. Repeat part (a) assuming the firm goes through with the proposed recapitalization.
	3. Repeat parts (a) and (b) of this problem assuming the firm has a tax rate of 35 percent.
2. Star, Inc., a prominent consumer products firm, is debating whether or not to convert its all-equity capital structure to one that is 40 percent debt. Currently, there are 2,000 shares outstanding and the price per share is $70. EBIT is expected to remain at $16,000 per year forever. The interest rate on new debt is 8 percent, and there are no taxes.
	1. Ms. Knowles, a shareholder of the firm, owns 100 shares of stock. What is her cash flow under the current capital structure, assuming the firm has a dividend payout rate of 100 percent?
	2. What will Ms. Knowles' cash flow be under the proposed capital structure of the firm? Assume that she keeps all 100 of her shares.
	3. Suppose Star does convert, but Ms. Knowles prefers the current all-equity capital structure. Show how she could unlever her shares of stock to recreate the original capital structure.
	4. Using your answer to part (c), explain why Star's choice of capital structure is irrelevant.
3. ABC Co. and XYZ Co. are identical firms in all respects except for their capital structure. ABC is all-equity financed with $600,000 in stock. XYZ uses both stock and perpetual debt; its stock is worth $300,000 and the interest rate on its debt is 10 percent. Both firms expect EBIT to be $73,000. Ignore taxes.
	1. Rico owns $30,000 worth of XYZ's stock. What rate of return is she expecting?
	2. Show how Rico could generate exactly the same cash flows and rate of return by investing in ABC and using homemade leverage.
	3. What is the cost of equity for ABC? What is it for XYZ?

**Capital Structure**

1. Moon Beam Industries has a debt-equity ratio of 1.5. Its WACC is 12 percent, and its cost of debt is 12 percent. The corporate tax rate is 35 percent.
	1. What is Moon Beam's cost of equity capital?
	2. What is Moon Beam's unlevered cost of equity capital?
	3. What would the cost of equity be if the debt-equity ratio were 2? What if it were 1.0? What if it were zero?
2. Bruce & Co. expects its EBIT to be $95,000 every year forever. The firm can borrow at 11 percent. Bruce currently has no debt, and its cost of equity is 22 percent. If the tax rate is 35 percent, what is the value of the firm? What will the value be if Bruce borrows $60,000 and uses the proceeds to repurchase shares?
3. Tool Manufacturing has an expected EBIT of $35,000 in perpetuity and a tax rate of 35 percent. The firm has $70,000 in outstanding debt at an interest rate of 9 percent, and its unlevered cost of capital is 14 percent. What is the value of the firm according to M&M Proposition I with taxes? Should Tool change its debt-equity ratio if the goal is to maximize the value of the firm? Explain.
4. Old School Corporation expects an EBIT of $9,000 every year forever. Old School currently has no debt, and its cost of equity is 17 percent. The firm can borrow at 10 percent. If the corporate tax rate is 35 percent, what is the value of the firm? What will the value be if Old School converts to 50 percent debt? To 100 percent debt?

**Solutions**

**Leverage**

1. *a.* Since the company has a market-to-book ratio of 1.0, the total equity of the firm is equal to the market value of equity. Using the equation for ROE:

 ROE = NI/$150,000

 The ROE for each state of the economy under the current capital structure and no taxes is:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  | Recession | Normal | Expansion |
|  |  | ROE | .0373 | .0933 | .1213 |
|  |  | %ΔROE | –60 | ––– | +30 |

 The second row shows the percentage change in ROE from the normal economy.

 *b.* If the company undertakes the proposed recapitalization, the new equity value will be:

 Equity = $150,000 – 60,000

 Equity = $90,000

 So, the ROE for each state of the economy is:

 ROE = NI/$90,000

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  | Recession | Normal | Expansion |
|  |  | ROE | .0222 | .1156 | .1622 |
|  |  | %ΔROE | –76.36 | ––– | +38.18 |

 *c.* If there are corporate taxes and the company maintains its current capital structure, the ROE is:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | ROE | .0243 | .0607 | .0789 |
|  |  | %ΔROE | –60 | ––– | +30 |

 If the company undertakes the proposed recapitalization, and there are corporate taxes, the ROE for each state of the economy is:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | ROE | .0144 | .0751 | .1054 |
|  |  | %ΔROE | –76.36 | ––– | +38.18 |

 Notice that the percentage change in ROE is the same as the percentage change in EPS. The percentage change in ROE is also the same with or without taxes.

2. *a.* The earnings per share are:

 EPS = $16,000/2,000 shares

 EPS = $8.00

 So, the cash flow for the company is:

 Cash flow = $8.00(100 shares)

 Cash flow = $800

 *b.* To determine the cash flow to the shareholder, we need to determine the EPS of the firm under the proposed capital structure. The market value of the firm is:

 V = $70(2,000)

 V = $140,000

 Under the proposed capital structure, the firm will raise new debt in the amount of:

 D = 0.40($140,000)

 D = $56,000

 in debt. This means the number of shares repurchased will be:

 Shares repurchased = $56,000/$70

 Shares repurchased = 800

 Under the new capital structure, the company will have to make an interest payment on the new debt. The net income with the interest payment will be:

 NI = $16,000 – .08($56,000)

 NI = $11,520

 This means the EPS under the new capital structure will be:

 EPS = $11,520/1,200 shares

 EPS = $9.60

 Since all earnings are paid as dividends, the shareholder will receive:

 Shareholder cash flow = $9.60(100 shares)

 Shareholder cash flow = $960

 *c.* To replicate the proposed capital structure, the shareholder should sell 40 percent of their shares, or 40 shares, and lend the proceeds at 8 percent. The shareholder will have an interest cash flow of:

 Interest cash flow = 40($70)(.08)

 Interest cash flow = $224

 The shareholder will receive dividend payments on the remaining 60 shares, so the dividends received will be:

 Dividends received = $9.60(60 shares)

 Dividends received = $576

 The total cash flow for the shareholder under these assumptions will be:

 Total cash flow = $224 + 576

 Total cash flow = $800

 This is the same cash flow we calculated in part *a*.

 *d.* The capital structure is irrelevant because shareholders can create their own leverage or unlever the stock to create the payoff they desire, regardless of the capital structure the firm actually chooses.

3. *a.* The rate of return earned will be the dividend yield. The company has debt, so it must make an interest payment. The net income for the company is:

 NI = $73,000 – .10($300,000)

 NI = $43,000

 The investor will receive dividends in proportion to the percentage of the company’s share they own. The total dividends received by the shareholder will be:

 Dividends received = $43,000($30,000/$300,000)

 Dividends received = $4,300

 So the return the shareholder expects is:

 R = $4,300/$30,000

 R = .1433 or 14.33%

 *b.* To generate exactly the same cash flows in the other company, the shareholder needs to match the capital structure of ABC. The shareholder should sell all shares in XYZ. This will net $30,000. The shareholder should then borrow $30,000. This will create an interest cash flow of:

 Interest cash flow = .10($30,000)

 Interest cash flow = –$3,000

 The investor should then use the proceeds of the stock sale and the loan to buy shares in ABC. The investor will receive dividends in proportion to the percentage of the company’s share they own. The total dividends received by the shareholder will be:

 Dividends received = $73,000($60,000/$600,000)

 Dividends received = $7,300

 The total cash flow for the shareholder will be:

 Total cash flow = $7,300 – 3,000

 Total cash flow = $4,300

 The shareholders return in this case will be:

 R = $4,300/$30,000

 R = .1433 or 14.33%

 *c.* ABC is an all equity company, so:

 RE = RA = $73,000/$600,000

 RE = .1217 or 12.17%

 To find the cost of equity for XYZ we need to use M&M Proposition II, so:

 RE = RA + (RA – RD)(D/E)(1 – tC)

 RE = .1217 + (.1217 – .10)(1)(1)

 RE = .1433 or 14.33%

 *d.* To find the WACC for each company we need to use the WACC equation:

 WACC = (E/V)RE + (D/V)RD(1 – tC)

 So, for ABC, the WACC is:

 WACC = (1)(.1217) + (0)(.10)

 WACC = .1217 or 12.17%

 And for XYZ, the WACC is:

 WACC = (1/2)(.1433) + (1/2)(.10)

 WACC = .1217 or 12.17%

 When there are no corporate taxes, the cost of capital for the firm is unaffected by the capital structure; this is M&M Proposition I without taxes.

**Capital Structure**

4. *a.* With the information provided, we can use the equation for calculating WACC to find the cost of equity. The equation for WACC is:

 WACC = (E/V)RE + (D/V)RD(1 – tC)

 The company has a debt-equity ratio of 1.5, which implies the weight of debt is 1.5/2.5, and the weight of equity is 1/2.5, so

 WACC = .12 = (1/2.5)RE + (1.5/2.5)(.12)(1 – .35)

 RE = .1830 or 18.30%

 *b.* To find the unlevered cost of equity we need to use M&M Proposition II with taxes, so:

 RE = RU + (RU – RD)(D/E)(1 – tC)

 .1830 = RU + (RU – .12)(1.5)(1 – .35)

 RU = .1519 or 15.19%

 *c.* To find the cost of equity under different capital structures, we can again use the WACC equation. With a debt-equity ratio of 2, the cost of equity is:

 .12 = (1/3)RE + (2/3)(.12)(1 – .35)

 RE = .2040 or 20.40%

 With a debt-equity ratio of 1.0, the cost of equity is:

 .12 = (1/2)RE + (1/2)(.12)(1 – .35)

 RE = .1620 or 16.20%

 And with a debt-equity ratio of 0, the cost of equity is:

 .12 = (1)RE + (0)(.12)(1 – .35)

 RE = WACC = .12 or 12%

5. *a.* The value of the unlevered firm is:

 V = EBIT(1 – tC)/RU

 V = $95,000(1 – .35)/.22

 V = $280,681.82

 *b.* The value of the levered firm is:

 V = VU + tCD

 V = $280,681.82 + .35($60,000)

 V = $301,681.82

6. To find the value of the levered firm we first need to find the value of an unlevered firm. So, the value of the unlevered firm is:

 VU = EBIT(1 – tC)/RU

 VU = ($35,000)(1 – .35)/.14

 VU = $162,500

 Now we can find the value of the levered firm as:

 VL = VU  + tCD

 VL = $162,500 + .35($70,000)

 VL = $187,000

 Applying M&M Proposition I with taxes, the firm has increased its value by issuing debt. As long as M&M Proposition I holds, that is, there are no bankruptcy costs and so forth, then the company should continue to increase its debt/equity ratio to maximize the value of the firm.

7. With no debt, we are finding the value of an unlevered firm, so:

 V = EBIT(1 – tC)/RU

 V = $9,000(1 – .35)/.17

 V = $34,411.76

 With debt, we simply need to use the equation for the value of a levered firm. With 50 percent debt, one-half of the firm value is debt, so the value of the levered firm is:

 V= VU  + tCD

 V = $34,411.76 + .35($34,411.76/2)

 V = $40,433.82

 And with 100 percent debt, the value of the firm is:

 V= VU  + tCD

 V = $34,411.76 + .35($34,411.76)

 V = $46,455.88