## Short-Answer

1. Briefly give the basic reason that if two firms have the same EBIT, the higher growth firm will tend to have a lower debt to value ratio.

   1) if two firms have the same EBIT, they will have the same tax-optimal debt levels
   2) high grown firms have higher values relative to current EBIT due to higher future growth

For problems 2 through 7 assume that the corporate tax rate is 35%, that the personal tax rate on equity income is 15%, and that the personal tax rate on interest income is 30%.

2. ATAway Airlines has earnings before interest and taxes of $100,000 per year. Assume that ATAway issues risk-free bonds for $500,000 that never mature. What is the after-tax cash flow per year paid to investors by the firm if the risk-free interest rate is 3%?

   100,000(1 – .35) + (.35)(500,000)(.03)

   or,

   (100,000 – (500,000)(.03))(1 – .35) + 500,000(.03)

3. There is a 15% chance that DellFired Inc.'s EBIT will be $75 million, a 60% chance that it will be $100 million, and a 25% chance that it will be $125 million. What is DellFired's effective tax advantage of debt if their current interest expense is $80 million?

   $$E(\tau_C) = .85(.35)$$

   $$\tau^* = 1 - \frac{(1 - E(\tau_C))(1 - .15)}{(1 - .3)}$$

4. DellFired Inc. currently has no debt and has a market value of $10,000,000 and will earn $100,000 per year forever. What would be the value of DellFired if it issued $2,000,000 of risk-free permanent debt at an interest rate of 4% per year?

   $$\tau^* = 1 - \frac{(1 - .35)(1 - .15)}{(1 - .3)}$$

   $$V^L = 10{,}000{,}000 + \tau^*(2{,}000{,}000)$$

5. Assume that ATAway Airlines Inc.'s EBIT will equal $100,000 per year and that it currently pays $100,000 per year of interest on its debt. How will issuing an additional $500,000 of debt impact the value of ATAway Airlines' assets?

   $$\tau^* = 1 - \frac{(1 - 0)(1 - .15)}{(1 - .3)} = \frac{.15 - .3}{1 - .3}$$

   $$\Rightarrow \tau^*(500{,}000)$$

6. Assume that DellFired's equity has a market value of $100 million and a book value of $20 million. Assume also that DellFired's debt (which is risk-free) has a market value of $30 million and a book value of $27.5 million. Finally, assume that DellFired's cost of equity capital is 12% and the risk-free rate is 4%. What is DellFired's after-tax weighted average cost of capital?

$$\left(\frac{100}{100+30}\right)(.12)+\left(\frac{30}{100+30}\right)(.04)(1-.35)$$

7. Ford CEO Bucks has a 10% chance of earning $100 million, a 50% chance of earning $125 million, and a 40% chance of earning $150 million. Ford CEO Bucks' current interest expense is $110 million. What is Ford CEO Buck's effective tax advantage for issuing debt that will pay an additional $10 million per year of interest?

$$E(\tau_C)=.9(.35)$$

$$\tau^* = 1-\frac{(1-E(\tau_C))(1-.15)}{(1-.3)}$$

8. If the Obama administration were to want to reduce the amount of debt used by the typical firm, what changes to tax rates (personal and corporate) should they make? Note: you do not need to explain the changes, you can simply list the direction each tax rate would need to change.

   1) cut corporate tax rate, 2) cut personal tax rate on equity income, increase personal tax rate on interest income

9. How would an increase in corporate tax rates impact the optimal capital structure for a typical firm?

   The typical firm will want more debt.

# Problems

1. Assume that the corporate tax rate is 35%. Assume also that investors pay a tax rate of 15% on dividends and capital gains and a tax rate of 25% on interest income. Assume also that your firm will have risk-free earnings before interest and taxes of $100 million each year forever.
   a. If the firm currently pays interest of $60 million per year, how will issuing $10 million of additional permanent debt change the value of the firm?
   b. If the firm currently pays interest of $110 million per year, how will issuing $10 million of additional permanent debt change the value of the firm?

   a. $\left(1-\frac{(1-.35)(1-.15)}{1-.25}\right)(10)$

   b. $\left(\frac{.15-.25}{1-.25}\right)(10)$

2. Assume that the corporate tax rate is 25%, that investors pay a 15% tax rate on dividend income, and that investors pay a 35% tax rate on interest income. Assume also that Toy Ota Inc. (TO) has a 40% chance of earning an EBIT of $3,000,000 and a 60% chance of earning an EBIT of $5,000,000.

   a. Calculate TO's effective tax advantage of debt if its current interest expense is $1,000,000, $4,000,000, and $9,000,000.
   b. How would you determine TO's optimal capital structure? Note: Rather than writing out how you would find TO's optimal capital structure, you can do some actual calculations and then use your results to identify TO's optimal capital structure.

   a. $\tau^* = 1-\frac{(1-E(\tau_C))(1-.15)}{(1-.35)}$

   1,000,000: $E(\tau_c) = .25$
   4,000,000: $E(\tau_c) = .6(.25)$
   9,000,000: $E(\tau_c) = 0$

   b. $\tau^*$ (Interest < 3,000,000) = .0192
   $\tau^*$ (Interest 3,000,000 to 5,000,000) = -.11154
   => optimal debt = 3,000,000

Chapter 15 Problems

3. Assume that the corporate tax rate is 40%, that the personal tax rate on interest income is 30%, and that the personal tax rate on equity income is 20%. Assume also that there is a 15% chance that ST&T will have an EBIT of $3,000,000, a 35% chance that ST&T will have an EBIT of $5,000,000, and a 50% chance that ST&T will have an EBIT of $7,000,000. What level of interest provides ST&T with the greatest tax benefit?

   Note: I highly recommend that you do some actual calculations to answer this question. Otherwise you'll need to set up all the relevant calculations and then discuss how you would use these calculations to determine ST&T's optimal capital structure.

   $\tau^* = 1 - \frac{(1-E(\tau_C))(1-\tau_e)}{1-\tau_i}$

   $\tau_e = .2,\ \tau_i = .3$

   **<u>0 – 3</u>**

   $E(\tau_c) = 1(.4) = .4$

   $\tau^* = 1 - \frac{(1-.4)(1-.2)}{1-.3} = .31428$

   **<u>3 – 5</u>**

   $E(\tau_c) = .85(.4) = .34$

   $\tau^* = 1 - \frac{(1-.34)(1-.2)}{1-.3} = .24571$

   **<u>5 – 7</u>**

   $E(\tau_c) = .5(.4) = .2$

   $\tau^* = 1 - \frac{(1-.2)(1-.2)}{1-.3} = .0857$

   **<u>7+</u>**

   $E(\tau_c) = 0$

   $\tau^* = 1 - \frac{(1-0)(1-.2)}{1-.3} = -.14286$

   => optimal = 7

4. Applied Science Inc. has outstanding debt of $25 million on which it pays interest of $2.5 million per year. Applied Science's marginal tax rate is 35%. For individuals, the marginal tax rate on equity income is 15% and on interest income is 25%. Applied Science estimates that there is a 20% chance that its Earnings Before Interest and Taxes (EBIT) will equal $1 million, a 35% chance that its EBIT will equal $2 million, a 30% chance that its EBIT will equal $3 million, and a 15% chance that its EBIT will equal $4 million. Applied Science is considering whether or not to issue an additional $3 million of debt on which it would pay $300,000 of interest. It would use the proceeds of the debt issue to repurchase shares.
   a. Calculate the effective tax advantage of this new debt?
   b. How will issuing this debt impact the value of the firm?
   c. Without doing any calculations, discuss how Applied Science would determine its optimal debt level?

   a. $E(\tau_C) = .45(.35)$; $\tau^* = 1 - \frac{(1-E(\tau_C))(1-.15)}{(1-.25)}$

   b. $+\tau^* \times 3$

   c. Issue as long as $\tau^* > 0$

5. Assume that the corporate tax rate is 35%. Assume also that investors pay a tax rate of 15% on dividends and capital gains and a tax rate of 25% on interest income. Assume also that your firm will have risk-free earnings before interest and taxes of $100 million each year forever.

   a. If the firm currently pays interest of $60 million per year, how will issuing $10 million of additional debt change the value of the firm?
   b. If the firm currently pays interest of $110 million per year, how will issuing $10 million of additional debt change the value of the firm?

   a. $\left(1 - \frac{(1-.35)(1-.15)}{1-.25}\right)(10)$

   b. $\left(\frac{.15-.25}{1-.25}\right)(10)$

# Multiple-Choice

1. Assume a firm is currently funded only with equity and has a market value of $1,000,000. What will the firm be worth if it issues $300,000 of permanent debt and uses the proceeds to repurchase stock if the corporate tax rate is 35%?

a. 1,350,000
**B**. 1,105,000
c. 1,300,000
d. 1,405,000
e. 1,000,000

2. Which of the following will result in the firm's weighted average cost of capital falling?

(1) an increase in the corporate tax rate
(2) a decrease in the corporate tax rate
(3) an increase in the personal tax rate on equity income
(4) a decrease in the personal tax rate on equity income
(5) an increase in the personal tax rate on interest income
(6) a decrease in the personal tax rate on interest income

a. (2), (4), and (6)
b. (2), (3), and (5)
c. (1), (3), and (6)
**D**. (1), (4), and (6)
e. (2), (4), and (5)

Chapter 15 Problems

Use the following information to answer questions 3 and 4.

Assume that the tax rate on corporate income is 35%, that the tax rate investors pay on equity income is 10% and that the tax rate investors pay on interest income is 25%. Assume also that GIA Inc.'s possible earnings before interest and taxes (EBIT) will depend on the economy as follows:

| Economy | Probability | EBIT |
|---|---|---|
| Boom | .10 | 3,000,000 |
| Good | .35 | 2,200,000 |
| Poor | .40 | 1,500,000 |
| Terrible | .15 | 600,000 |

3. If GIA currently has interest payments of $1,000,000, calculate its effective tax advantage of debt.

**A**. $1-\left(\frac{(1-(.85\times.35))(1-.1)}{1-.25}\right)$

b. $1-\left(\frac{(1-(.15\times.35))(1-.1)}{1-.25}\right)$

c. $1-\left(\frac{(1-.35)(1-.1)}{1-.25}\right)$

d. $1-\left(\frac{(1-(.55\times.35))(1-.1)}{1-.25}\right)$

e. $1-\left(\frac{(1-(.4\times.35))(1-.1)}{1-.25}\right)$

4. What is GIA's optimal level of interest payments?

a. 2,200,000
**B**. 1,500,000
c. more than 3,000,000
d. 3,000,000
e. 600,000

5. Under the current U.S. tax code, which of the following correctly describes the impact of taxes on a firm's optimal capital structure?

a. an increase in personal taxes on debt income increases a firm's incentive to issue debt
b. an increase in personal taxes on equity income reduces a firm's incentive to issue debt
c. the tax deductibility for firms of preferred stock dividends creates an incentive for firms to issue preferred stock
d. an increase in corporate taxes reduces a firm's incentive to issue debt
**E**. none of the above

6. Baxter Industries currently has $100 million of outstanding debt with an interest rate of 5%. Assume that Baxter's earnings before interest and taxes currently equals $90 million per year, that its marginal corporate tax rate is 35%, and that none of these numbers are expected to change. What is Baxter's annual interest tax shield from its outstanding debt?

a. $2.6 million
**B**. $1.75 million
c. $1.4 million
d. $31.5 million

e. $3.25 million