

# **GESTÃO FINANCEIRA II**

## **PROBLEM SET 7: Solutions**

Chapters 15 and 16

Debt and Personal Taxes

Financial Distress, Managerial Incentives, and  
Information

(FROM BERK AND DEMARZO'S "CORPORATE FINANCE")

**LICENCIATURA - UNDERGRADUATE COURSE**

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## Chapter 15

### Debt and Personal Taxes

**15-20. Suppose the corporate tax rate is 40%, and investors pay a tax rate of 15% on income from dividends or capital gains and a tax rate of 33.3% on interest income. Your firm decides to add debt so it will pay an additional \$15 million in interest each year. It will pay this interest expense by cutting its dividend.**

- a. How much will debt holders receive after paying taxes on the interest they earn?**

$$\$15 \times (1 - .333) = \$10 \text{ million each year}$$

- b. By how much will the firm need to cut its dividend each year to pay this interest expense?**

Given a corporate tax rate of 40%, an interest expense of \$15 million per year reduces net income by  $15(1 - .4) = \$9$  million after corporate taxes.

- c. By how much will this cut in the dividend reduce equity holders' annual after-tax income?**

$$\$9 \text{ million dividend cut} \Rightarrow \$9 \times (1 - .15) = \$7.65 \text{ million per year.}$$

- d. How much less will the government receive in total tax revenues each year?**

$$\text{Interest taxes} = .333 \times 15 = \$5 \text{ million}$$

$$\text{Less corporate taxes} = .40 \times 15 = \$6 \text{ million}$$

$$\text{Less dividend taxes} = .15 \times 9 = \$1.35 \text{ million}$$

$$\Rightarrow \text{Govt tax revenues change by } 5 - 6 - 1.35 = \$2.35 \text{ million}$$

(Note this equals (a) - (c)).

- e. What is the effective tax advantage of debt  $\tau^*$ ?**

$$\tau^* = 1 - \frac{(1 - 0.40)(1 - 0.15)}{1 - 0.333} = 23.5\%$$

**15-22. Markum Enterprises is considering permanently adding \$100 million of debt to its capital structure. Markum's corporate tax rate is 35%.**

- a. Absent personal taxes, what is the value of the interest tax shield from the new debt?**

$$PV = \tau_c D = 35\% \times 100 = \$35 \text{ million.}$$

- b. If investors pay a tax rate of 40% on interest income, and a tax rate of 20% on income from dividends and capital gains, what is the value of the interest tax shield from the new debt?**

$$\tau^* = 1 - \frac{(1 - 0.35)(1 - 0.20)}{1 - 0.40} = 13.33\%$$

$$PV = \tau_c D = 13.33\% \times 100 = \$13.33 \text{ million}$$

## Chapter 16

### Financial Distress, Managerial Incentives, and Information

16-13. Your firm is considering issuing one-year debt, and has come up with the following estimates of the value of the interest tax shield and the probability of distress for different levels of debt:

	Debt Level (\$ million)						
	0	40	50	60	70	80	90
PV (interest tax shield, \$ million)	0.00	0.76	0.95	1.14	1.33	1.52	1.71
Probability of Financial Distress	0%	0%	1%	2%	7%	16%	31%

Suppose the firm has a beta of zero, so that the appropriate discount rate for financial distress costs is the risk-free rate of 5%. Which level of debt above is optimal if, in the event of distress, the firm will have distress costs equal to

- \$2 million? 80
- \$5 million? 60

	Debt Level (\$ million)							Tax
	0	40	50	60	70	80	90	
PV(interest tax shield)	0.00	0.76	0.95	1.14	1.33	1.52	1.71	40%
Prob(Financial Distress)	0%	0%	1%	2%	7%	16%	31%	20%
Distress Cost	5	5	5	5	5	5	5	Rf
PV(distress cost)	0.00	0.00	0.05	0.10	0.33	0.76	1.48	5%
Gain	0.00	0.76	0.90	1.05	1.00	0.76	0.24	
Optimal Debt		60						

- \$25 million? 40

16-20. Zymase is a biotechnology start-up firm. Researchers at Zymase must choose one of three different research strategies. The payoffs (after-tax) and their likelihood for each strategy are shown below. The risk of each project is diversifiable.

Strategy	Probability	Payoff (\$ million)
A	100%	75
B	50%	140
	50%	0
C	10%	300
	90%	40

- Which project has the highest expected payoff?

$$E(A) = \$75 \text{ million}$$

$$E(B) = 0.5 \times 140 = \$70 \text{ million}$$

$$E(C) = 0.1 \times 300 + 0.9 \times 40 = \$66 \text{ million}$$

Project A has the highest expected payoff.

- b. Suppose Zymase has debt of \$40 million due at the time of the project's payoff. Which project has the highest expected payoff for equity holders?**

$$E(A) = 75 - 40 = \$35 \text{ million}$$

$$E(B) = 0.5 \times (140 - 40) = \$50 \text{ million}$$

$$E(C) = 0.1 \times (300 - 40) + 0.9 \times (40 - 40) = \$26 \text{ million}$$

Project B has the highest expected payoff for equity holders.

- c. Suppose Zymase has debt of \$110 million due at the time of the project's payoff. Which project has the highest expected payoff for equity holders?**

$$E(A) = \$0 \text{ million}$$

$$E(B) = 0.5 \times (140 - 110) = \$15 \text{ million}$$

$$E(C) = 0.1 \times (300 - 110) = \$19 \text{ million}$$

Project C has the highest expected payoff for equity holders.

- d. If management chooses the strategy that maximizes the payoff to equity holders, what is the expected agency cost to the firm from having \$40 million in debt due? What is the expected agency cost to the firm from having \$110 million in debt due?**

With \$40 million in debt, management will choose project B, which has an expected payoff for the firm that is  $75 - 70 = \$5$  million less than project A. Thus, the expected agency cost is \$5 million.

With \$110 million in debt, management will choose project C, resulting in an expected agency cost of  $75 - 66 = \$9$  million.

**16-33. "We R Toys" (WRT) is considering expanding into new geographic markets. The expansion will have the same business risk as WRT's existing assets. The expansion will require an initial investment of \$50 million and is expected to generate perpetual EBIT of \$20 million per year. After the initial investment, future capital expenditures are expected to equal depreciation, and no further additions to net working capital are anticipated.**

**WRT's existing capital structure is composed of \$500 million in equity and \$300 million in debt (market values), with 10 million equity shares outstanding. The unlevered cost of capital is 10%, and WRT's debt is risk free with an interest rate of 4%. The corporate tax rate is 35%, and there are no personal taxes.**

- a. WRT initially proposes to fund the expansion by issuing equity. If investors were not expecting this expansion, and if they share WRT's view of the expansion's profitability, what will the share price be once the firm announces the expansion plan?**

$$\text{NPV of expansion} = 20 \times \frac{0.65}{0.1} - 50 = \$80 \text{ million}$$

$$\text{Equity value} = \frac{500 + 80}{10} = \$58/\text{share}$$

- b. Suppose investors think that the EBIT from WRT's expansion will be only \$4 million. What will the share price be in this case? How many shares will the firm need to issue?**

$$\text{NPV of expansion} = 4 \times \frac{0.65}{0.1} - 50 = -\$24 \text{ million} \quad \text{share price} = \frac{500 - 24}{10} = \$47.6 / \text{share}$$

$$\text{New shares} = \frac{50}{47.6} = 1.05 \text{ million shares}$$

- c. Suppose WRT issues equity as in part (b). Shortly after the issue, new information emerges that convinces investors that management was, in fact, correct regarding the cash flows from the expansion. What will the share price be now? Why does it differ from that found in part (a)?**

$$\text{Share price} = \frac{500 + 50 + 80}{11.05} = \$57 / \text{share}$$

The share price is now lower than the answer from part (a), because in part (a), share price is fairly valued, while here shares issued in part (b) are undervalued. New shareholders' gain of  $(57 - 47.6) \times 1.05 = \$10$  million = old shareholders' loss of  $(58 - 57) \times 10$ .

- d. Suppose WRT instead finances the expansion with a \$50 million issue of permanent riskfree debt. If WRT undertakes the expansion using debt, what is its new share price once the new information comes out? Comparing your answer with that in part (c), what are the two advantages of debt financing in this case?**

$$\text{Tax shield} = 35\%(50) = \$17.5 \text{ million}$$

$$\text{Share price} = \frac{500 + 50 + 80 + 17.5 - 50}{10} = \$59.75 \text{ per share.}$$

Gain of \$2.75 per share compared to case (c). \$1 = avoid issuing undervalued equity, and \$1.75 from interest tax shield.