

FIN 521: Problem Set #3

Due on Wednesday, April 11, 2018

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Question 1

- a. Since the risk is idiosyncratic, discount rate of the firm is 0. Because all the possibilities of future value is equally likely, Gladstone's current equity value is equal to $0.25 \times (150 + 135 + 95 + 80) = 115$ million dollars.
- b. If the firm earns \$150 or \$135 million in the future, debt holder would get 100% of face value. However, if the firm earns \$95 or \$80 million dollars in the future, debt holder would get \$95, \$80 million dollars, respectively. Since risk is diversifiable, current value of the debt is equal to $0.25 \times 100 + 100 + 95 + 80 = 93.75$.
- c. Yield is a discount rate affected to "promised" payoff. Expected return, in contrast, is a discount rate affected to "expected" payoff. Therefore, yield of the debt satisfies $\frac{100}{1+y} = 93.75$. Therefore $y = \frac{100-93.75}{93.75} = 6.67\%$. In order to calculate expected return, it needs to calculate expected payoff of the debt, from b. it is calculated as 93.75. Therefore, in this case, expected return is equal to 0. It is because there is no systematic risk.
- d. From a, expected present value of the future value is equal to 115. Since debt value is equal to 93.75, equity value is equal to $115 - 93.75 = 21.25$, and firm's total value is 115, which is same as a. Therefore, Modigliani & Miller I holds here.

Question 2

- a. Since the firm is unlevered, cost of capital of the firm is equal to unlevered cost of capital, which is 15%. Therefore, the firm value (present value of future free cash flow) is equal to as follows.

$$\begin{aligned} PV(FCF) &= \frac{5}{1.15} + \frac{5}{(1.15)^2} + \frac{5}{(1.15)^3} + \dots \\ &= \frac{5}{0.15} = 33.33 \end{aligned}$$

- b. In this case, we can calculate firm's value by adding present value of income tax shield to unlevered firm's value. Since the debt lasts permanently, present value of interest is same as current debt value. Therefore, interest tax shield is equal to (tax rate) \times (current debt value), so the firm value is equal to $33.33 + 0.35 \times 19.05 = 40$.

Question 3

- a. Before the announcement, since Kurz has 20 million outstanding shares and price per share is \$7.50, total value of the firm is equal to $7.50 \times 20 = 150$ million dollars because it is all-equity firm.

- b. Since investors know the effect of income tax shield, total value of the firm will be increased after the announcement, and the amount of increase is equal to amount of income tax shield. Assuming there is no excess cash in Kurz, because the debt is expected to be maintained permanently, the present value of income tax shield will be equal to $0.40 \times 50 = 20$ million dollars. Therefore, firm value will be increased to 170 million dollars, and it is all-equity.
- c. Since firm value is increased to 170 million dollars and there are 20 million outstanding shares, price per share increases to $170/20 = 8.5$. Therefore, Kurz will purchase about $50/8.5 = 5.89$ million shares.
- d. Since 50 million amount of shares are repurchased, equity value will decrease by 50 million, so equity value will be 120 million after repurchase. Since number of outstanding share also decreased, price per share is not changed. The price is $\frac{120}{20-5.89} = 8.5$, which is same as the price before repurchase.

Question 4

- a. Table 1 shows income tax shield and cost of financial distress and NPV, when cost of financial distress is equal to 2 million. In this case, the optimal debt is equal to \$80 million because NPV is the largest.

Debt Level	0	40	50	60	70	80	90
PV of Income Tax Shield	0	0.76	0.95	1.14	1.33	1.52	1.71
Probability of Financial Distress	0	0	0.01	0.02	0.07	0.16	0.31
Present Value of Financial Distress	0.000	0.000	0.019	0.038	0.133	0.305	0.590
NPV	0.000	0.760	0.931	1.102	1.197	1.215	1.120

Table 1: Income tax shield and cost of financial distress: 2 million

- b. Table 2 shows income tax shield and cost of financial distress and NPV, when cost of financial distress is equal to 5 million. In this case, the optimal debt is equal to \$60 million.

Debt Level	0	40	50	60	70	80	90
PV of Income Tax Shield	0	0.76	0.95	1.14	1.33	1.52	1.71
Probability of Financial Distress	0	0	0.01	0.02	0.07	0.16	0.31
Present Value of Financial Distress	0.000	0.000	0.048	0.095	0.333	0.762	1.476
NPV	0.000	0.760	0.902	1.045	0.997	0.758	0.234

Table 2: Income tax shield and cost of financial distress: 5 million

- c. Table 3 shows income tax shield and cost of financial distress and NPV, when cost of financial distress is equal to 25 million. In this case, the optimal debt is equal to \$40 million. From a, b, c, we can find that optimal debt decreases as cost of financial distress increases.

Debt Level	0	40	50	60	70	80	90
PV of Income Tax Shield	0	0.76	0.95	1.14	1.33	1.52	1.71
Probability of Financial Distress	0	0	0.01	0.02	0.07	0.16	0.31
Present Value of Financial Distress	0.000	0.000	0.238	0.476	1.667	3.810	7.381
NPV	0.000	0.760	0.712	0.664	-0.337	-2.290	-5.671

Table 3: Income tax shield and cost of financial distress: 25 million

Question 5

- a. Before paying dividend, since there are 500 million shares and current share price is \$15, market value of equity is equal to \$7,500 million. After paying dividend, equity value decreases to \$7,250 million, and since the number of share does not change, price per share decreases to $\frac{7,250}{500} = \$14.5$.
- b. If the board decided to repurchase the same amount of share, the number of share the firm will buy is equal to $250/15 = 16.7$ shares. After repurchase, equity value of firm decreases, and number of outstanding share also decreases. Therefore, price per share is equal to $\frac{7,250}{500-16.7} = 15$, which is unchanged.
- c. Firm's investors are indifferent to both decisions. From decision (a), amount of value for investor is 7,500, 7,250 is for equity, and the rest is for cash flow from dividend. Similarly, if the firm repurchase shares, value for investors is same because they get 250 million dollars for repurchase, and have 7,250 million dollars in equity.

Question 6

By selling shares which has same amount of desired dividend, the investor can make the same effect in which dividend is paid. If dividend is paid, investors get cash from dividend, but their equity value decreases because share price decreases. In this case, if shareholder sells shares to artificially make dividend, he will get cash flow from selling shares, and his equity value will decrease since the number of shares he has decreases.

Question 7

- a. If board of firm decided to increase dividend, it may be good signal because the management expects the firm can pay higher dividend than before which means the management expects firm value will be increased.
- b. Increasing dividend might be bad signal because it can be interpreted as manager of firm expects that there is not enough positive-NPV investment opportunities.

Question 8

- a. Under APV method, future free cash flows are discounted at unlevered cost of capital, then add present value of income tax shield or other cash flow from financial decision explicitly. In this case, since the firm is expected to generate free cash flows of \$10.9 million per year, present value of unlevered cash flow is equal to $\frac{10.9}{0.10} = 109$ million dollars. In addition, considering cost of debt is 5%, the amount of income tax shield at each year is equal to $40 \times 5\% \times 40\% = 0.8$ million dollars. Since there is a target amount of debt, the appropriate discount rate of income tax shield is cost of debt because risk of income tax shield is same as risk of debt in this case. Therefore, using perpetuity formula, present value of income tax shield is calculated as $\frac{0.8}{0.05} = 16$ million dollars. Therefore, enterprise value of the firm is estimated as $109 + 16 = 125$ million dollars. Assuming there is no excess cash in the firm, value of equity is calculated as $125 - 40 = 85$ million dollars.
- b. Under FTE method, equity value is calculated by discounting free cash flow to equity(FCFE). When discounting FCFE, cost of equity is used for discount rate. Since the firm maintain debt permanently, the amount of change in net debt is equal to zero. Therefore, FCFE at each year is calculated as $10.9 - (1 - 0.4) \times 2 = 9.7$ million dollars, which is $FCF - (1 - \text{tax rate}) \times \text{interest}$. Discounting at cost of equity, the amount of equity value under FTE method is equal to $\frac{9.7}{0.114} = 85.08$ million dollars, which is slightly larger than the value from APV method.