

FINE 342: Corporate Finance
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Midterm: Fall 2015 **Solutions**

Thursday Oct 29, 2015, 4:05pm to 5:35pm

- **Closed book and closed notes**
- **Answer in EXAM BOOKLET**
- **You are allowed a non-programmable calculator**
- **Show your work to receive credit, except for the True or False section**
- **This exam has a total of 6 problems on 4 pages, including the cover page and formula sheet.**

1) (20 points) Today is $t = 0$, investors are risk neutral and the risk free rate is 10%. Ignore taxes and bankruptcy costs. Company A has no debt and is looking to develop a new drug. It has no other assets. The company is looking to raise \$1M at $t = 0$ by selling a fraction x of the company to OneCapital. The \$1M will be used at $t = 0$ to fund phase one trials for a new drug.

At $t = 1$ the market will learn if phase 1 was successful or not. If it was not successful (70% chance) the company is worth 0. If it was successful (30% chance), the company will seek stage 2 financing at $t = 1$. In this case the company will look to sell a fraction y of the company to TwoCapital in exchange for \$2M to fund phase 2 trials at $t = 1$.

At $t = 5$ the market will learn if phase 2 was successful or not. If it was not successful (50% chance) the company is worth \$3M at $t = 5$. If it was successful (50% chance), the company is worth \$50M at $t = 5$.

- a) Write down one equation where the only unknown is x , the fractional ownership that OneCapital requires at $t = 0$ for them to be willing to pay \$1M at $t = 0$. You do not need to solve or isolate for x .

$$1 = x \frac{0.7(0) + 0.3 \left(0.5 \left(\frac{3}{1.10^4} \right) + 0.5 \left(\frac{50}{1.10^4} \right) - 2 \right)}{1.10}$$

- b) Write down one equation where the only unknown is y , the fractional ownership that TwoCapital requires at $t = 1$ for them to be willing to pay \$2M at $t = 1$. You do not need to solve or isolate for y .

$$2 = y \left[0.5 \left(\frac{3}{1.10^4} \right) + 0.5 \left(\frac{50}{1.10^4} \right) \right]$$

- c) At $t = 0$, prior to stage 1 financing Bernie owned 50% of the company. What fraction of the company does Bernie own at $t = 5$ assuming stages 1 and 2 were successful and he did not personally buy or sell shares. Express your answer as a function of x and y , where these variables were defined above. You do not need to solve the equation.

$$50\%(1-x)(1-y)$$

- d) If stage 2 financing costs were known to be \$4M instead of \$2M, would OneCapital have required x to be greater than, less than, or equal to your answer from part a. Explain briefly.

The company is less valuable since it takes more money to achieve the same payout. Thus they would have required x to be greater.

2) (15 points) Assume perfect frictionless markets. Leveraged company X has 500 shares outstanding and a market value of risk free debt equal to \$10,000. Unleveraged company Y has 100 shares outstanding. Both companies have identical assets and their EBITs depend on the state of the economy, but in each state of the economy both companies produce the same EBIT. The price per share of company X is \$60.

a) What is the fair price of 1 share of unleveraged company Y?

One share of Y is 1% of the equity. To replicate the payout of the unleveraged company you buy 1% of X's shares (5 shares), and you lend 1%(10,000) = 100. The total cost of the replicating strategy is 5(60) + 100 = 400, which is the price of one share of Y.

b) If the share price of company Y were \$1 greater than your answer to part a, describe how you would construct an arbitrage. Assume you are shorting 1 share of company Y. (You do not need to compute the magnitude of the arbitrage profit.)

Short one share of Y, buy 5 shares of X and lend \$100 at the risk free rate.

3) (15 points) F has assets worth \$1,000,000, has 20,000 shares at a price of \$20 per share, and has risk-free debt. Expected return on equity is 15%, and the risk-free rate is 3%.

F plans to buy new assets that generate an additional expected EBIT (=operating cash-flow) of \$50,000 per year (in perpetuity), and requires an investment of \$600,000 at $t = 0$. New assets do not affect the fundamental risk of the firm. The acquisition is financed through the issuance of new common stocks and does not affect the risk of existing debt. Ignore taxes and bankruptcy costs.

(Note: the original \$20 price per share did not take into account the NPV of the new project.)

- (a) What is the issue price? (Hint: first find r_0 to compute the NPV of the project.)
- (b) What is the expected return on equity after the operation? (Hint: use MM2)

See Solutions to extra problems Lecture 5.

4) (20 points, 25 mins) Today is $t = 0$, investors are risk neutral and the risk free rate is 10%. Ignore taxes and bankruptcy costs.

Company A has 10,000 shares outstanding and is looking to raise \$50M through an IPO. The proceeds of the IPO will be used to invest in Asset X. Asset X yields a single cash flow at $t = 1$ as follows:

- High state: \$H with probability 1/3
- Medium state: \$M with probability 1/3
- Low state: \$L with probability 1/3

The company has no other assets, and currently has 3 bonds outstanding:

- Bond A: 1-year zero coupon bond, with FV = \$60M (no convertibility)
- Bond B: 1-year zero coupon convertible bond, with FV = \$40M, convertible to 2,000 shares at $t = 1$
- Bond C: 1-year zero coupon convertible bond, with FV = \$20M, convertible to 3,000 shares at $t = 1$

You may assume that:

- Default occurs only in the low state.
- Bond B gets converted to shares only in the high state.
- Bond C gets converted to shares in the high and medium states, but not the low state.
- Each of the three bonds is unsecured and has the same seniority in case of default.
- In a default, the bonds receive liquidated assets on a pro-rata basis based on face value, and convertibility is irrelevant.

- a) Write down one equation where the only variables are N, H, M, and L (where N is the number of shares that the company has to issue at t = 0 to raise the required \$50M). You do not need to solve or isolate for N.

$$50,000,000 = \left(\frac{1}{3}\right) \frac{N}{10,000 + N + 2,000 + 3,000} \left[\frac{H - 60,000,000}{1.1} \right]$$

$$+ \left(\frac{1}{3}\right) \frac{N}{10,000 + N + 3,000} \left[\frac{M - 60,000,000 - 40,000,000}{1.1} \right]$$

$$+ \left(\frac{1}{3}\right) \frac{N}{10,000 + N} \left[\frac{0}{1.1} \right]$$

- b) Write down the equation for the fair price of bond B, where your equation may contain some or all of the variables N, H, M, and L.

$$B_0^B = \left(\frac{1}{3}\right) \frac{2,000}{10,000 + N + 2,000 + 3,000} \left[\frac{H - 60,000,000}{1.1} \right]$$

$$+ \left(\frac{1}{3}\right) \left[\frac{40,000,000}{1.1} \right]$$

$$+ \left(\frac{1}{3}\right) \frac{40}{60 + 40 + 20} \left[\frac{L}{1.1} \right]$$

Note: 40/(60+40+20) is the pro-rate claim of bond B in case of default.

- c) If bond B could be converted into 4,000 shares (instead of 2,000), would this imply more or less shares would need to be issued at t = 0 in exchange for the \$50M?

IPO investors would take into account that they would get even more diluted in this case, so they would require a greater number of shares in the IPO.

5) (15 points, 20 mins) Company F is considering an SEO to finance a project that has an NPV of \$200M. The company's current share price is \$28 (this is the fair price prior to the market learning of the new positive NPV project). Initially there are 100M shares outstanding. The company's CFO, Elmo, suggests issuing 5M shares at a price of \$20 each. In particular, Elmo suggests the entire offering should be allocated to Scam Capital, a small Hedge Fund that has expressed an interest in taking a stake in the company.

- a) If the existence of the positive NPV project and SEO structure were to be simultaneously announced, what would the share price adjust to right after the announcement?

$$\frac{28(100M) + 200M + 20(5M)}{100M + 5M} = 29.52$$

The numerator is the total value of equity after the stock issuance, and the denominator is the total number of shares after issuance. Even though the issuance has not yet occurred, the market anticipates that this will be the price after issuance, and so the price adjusts immediately on the announcement.

b) Continue to assume the same NPV project exists. But suppose the company were to proceed with an SEO for 5M shares, priced at \$20, but this time including a rights issue, where each current shareholder gets 1 right per share, and it takes 20 rights to purchase a share in the SEO. How much is 1 right worth? (In calculating the value of 1 right, you may take into account that the market is aware of the positive NPV project.)

It takes 20 rights to buy 1 share in the SEO. The share price will eventually drop to 29.52 on the ex-rights date. Being able to buy a security that is worth 29.52 for a price of 20 has a value of 9.52 per share. But since it takes 20 rights to buy 1 share, the value per right is $9.52/20 = 0.48$

You could have also obtained this result as $30 - 29.52 = 0.48$ (where $30 = 28 + 2$ incorporates the \$2 of NPV per share from the new project). Shareholder wealth is not affected by the SEO with rights offering. The eventual decrease in stock price is offset by the value of the right.

6) (15 points) There are no taxes for the question below. In case of default, assume a bankruptcy cost of Z% of the value of the firm is incurred. Investors are risk-neutral and the risk free rate is 5%.

- F firm value in one year is \$8 million or \$5 million with equal probability.
 - F has existing debt, face value \$2 million, zero-coupon, maturity one year.
 - F raises additional debt: 4 new bonds, each with face value \$1 million, zero-coupon, maturity 1 year, same seniority as existing debt. The proceeds from the issuance are immediately distributed to stockholders.
- a) Without any calculations, explain briefly whether the above operation increases, decreases, or leaves **firm value** unchanged?
Since there are no taxes, and therefore no tax benefit of debt, there is only costs of bankruptcy, so firm value decreases.
- b) Can you say whether the operation will necessarily leave **shareholder wealth** unchanged, increase shareholder wealth, or decrease shareholder wealth? Justify your answer.
We can't say for sure as it depends on the level Z of bankruptcy costs. On the one hand the operation is bad because it decreases overall firm value through the bankruptcy cost effect. On the other hand, there is a redistribution of wealth from pre-existing bondholders to shareholders. Which effect dominates depends on the level of Z.
- c) If the new bonds **ranked junior to the pre-existing bond**, would the operation **increase, decrease, or leave shareholder wealth unchanged**? Answer without any calculations.

If the new bonds rank junior, then the pre-existing bonds are not affected by the issuance and there is no redistribution of wealth from pre-existing bondholders to shareholders. The only effect is the decreased firm value through the bankruptcy costs effect, and this is at the expense of shareholders. Thus shareholder wealth would decrease.

Corporate Finance Formula Sheet

$$S + B = S_0 + TS$$

$$r_s = r_0 + (1 - T_C) \frac{B}{S} (r_0 - r_B) = r_0 + (1 - T_C) L (r_0 - r_B)$$

$$r_0 = \frac{S}{S + B(1 - T_C)} r_s + \frac{B}{S + B(1 - T_C)} (1 - T_C) r_B$$

$$r_0 = \frac{1}{1 + L(1 - T_C)} r_s + \frac{L}{1 + L(1 - T_C)} (1 - T_C) r_B$$

$$WACC = \frac{S}{S + B} r_s + \frac{B}{S + B} (1 - T_C) r_B$$

$$WACC = \left[\frac{S}{S + B} + \frac{B}{S + B} (1 - T_C) \right] r_0 = \frac{1 + L(1 - T_C)}{1 + L} r_0$$

$$\beta_s = \beta_0 + (1 - T_C) \frac{B}{S} (\beta_0 - \beta_B) = \beta_0 + (1 - T_C) L (\beta_0 - \beta_B)$$