

FINE 342: Finance 2
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Midterm: Fall 2014 SOLUTIONS

Friday Oct 31, 2014, 3pm to 5pm
Happy Halloween!

Name:

Student ID:

- Closed book and closed notes
- Answer directly on this exam
- 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 9 problems on 11 pages, including the cover page and formula sheet. You may detach the formula sheet if you like

1) (5 points, 5 min) Today is $t = 0$. Assume all investors are risk neutral and the risk free rate is 10%. Vapepsi is seeking to raise \$100M in an IPO to expand operations internationally.

There is a 50% chance the expansion will be very successful, in which case the company will be worth \$390M at $t = 1$. There is a 50% chance the expansion will be moderately successful, in which case the company will be worth \$270M at $t = 1$.

At $t = 0$ there are 10M shares outstanding. **How many shares** need to be issued, and **at what price**, in order to raise the required \$100M?

$$100M = \frac{N}{10M + N} \left[0.5 \left(\frac{270}{1.1} \right) + 0.5 \left(\frac{390}{1.1} \right) \right]$$

→ $N = 5M$

→ $P = 100M/5M = \$20$

2) (15 points, 20 mins) Assume the same information as in question 1 above, except this time also assume that the CEO of the company has accumulated stock options, which give him the right, but not the obligation, to purchase 1M shares from the company at a price of \$19 per share 1 day after the IPO. If the shares are exercised, the company issues an extra 1M shares to the CEO at a price of \$19 each, and the company gets that cash.

Assume that the uncertainty about the future prospects of the international expansion will be resolved 1 day after the IPO. If the expansion is expected to be very successful, the CEO will exercise the options. Otherwise, he will not (and the options will never be exercised). (Although the uncertainty is resolved 1 day after the IPO, you can ignore this small passage of time when discounting.)

a) Given the existence of the stock options, **write down one equation where the only unknown is N**, where N represents the number of shares Vapepsi would have to issue in the IPO to raise the \$100M (before the CEO potentially exercises the options), such that investors would be willing to participate in the IPO. You do not need to solve or isolate for N. (Hint: This is not too different from the over-allotment problem from Assignment 1.)

$$100M = 0.5 \left[\frac{N}{10M + N} \left(\frac{270M}{1.1} \right) \right] + 0.5 \left[\frac{N}{10M + N + 1M} \left(\left(\frac{390M}{1.1} \right) + 1M(19) \right) \right]$$

b) If you were to solve for N in part a, would it be **greater, equal, or less than** the number of shares you would have to issue to raise the \$100M if there were no stock options? Justify briefly. No calculations are required.

It would be **greater** since the IPO investors need a larger fractional ownership to compensate them for the fact that in the good state the CEO will be able to buy shares from the company for less than their fair value.

c) Instead of \$19, assume the CEO could purchase those 1M shares at a price of \$18 from the company right after the IPO. Would the fair issue price in the IPO be **greater, equal, or less than** the fair issue price implied by your answer to part a? Explain briefly. No calculations are required.

The IPO price would be **lower** than in part a because in the good state the CEO will buy shares at an even lower price than in part a, which means the company will be worth less than in part a.

3) (10 points, 10 mins) Company F is considering an SEO. The company's current share price is \$30 (assume this is the fair price as well) and there are now 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 this SEO structure were to be announced, **what would the share price adjust to right after the announcement?**

$$\frac{30(100M) + 20(5M)}{100M + 5M} = 29.52$$

b) 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?**

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 $30 - 29.52 = 0.48$. 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.

4) (10 points, 10 mins) Company F has the following debt outstanding:

Tranche S1: Senior Secured, Face Value = 110bn, Secured by Asset A

Tranche J1: Junior Secured, Face Value = 50bn, Secured by Asset B, (ranks most senior with respect to Asset B since it is secured by Asset B, but ranks lower than S1 with respect to unpledged assets).

Tranche D: Unsecured Debt, Face Value = 90bn (same seniority as J1 with respect to unpledged assets)

In the event that F goes bankrupt and is liquidated assume:

value of Asset A = 10bn, value of Asset B = 40bn, value of unpledged assets = 150bn.

Describe **how much each category of debtholders recovers** in case of bankruptcy and liquidation? (neglect due interests)

S1 gets 10 from Asset A, and then has a claim of 100 on unpledged assets, which it can recover. So A, gets paid in full. A gets 110bn.

J1 gets 40 from Asset B, and has a claim of 10 on unpledged assets, of which there is 50 left after A's claim.

D has a claim of 90 on unpledged assets, same seniority as J1. The remaining 90 of unpledged assets has to be divided on a pro rata basis to J1 and D:

J1: $40 + [10/(10+90)](50) = 45\text{bn for J1,}$

D: $[90/(10+90)](50) = 45\text{bn for D.}$

5) (10 points, 10 mins) Firm F's next year expected EBIT is \$1,000,000. EBIT is growing at an annual rate of 2%. F's unlevered cost of equity is 10%. F has constant perpetual debt with market value and face value of \$3M. The coupon rate and risk free rate are equal to 3%. The corporate tax rate is 30%.

a) Compute **equity value using the APV** approach.

$$\text{Tax-adjusted EBIT: } (1M)(1-0.3) = 700,000$$

$$\text{Unlevered equity: } S_0 = 700,000 / (10\% - 2\%) = 8.75M$$

$$\text{TS of constant perpetual debt} = BT_c = 3M(0.30) = 0.9M$$

$$S + B = S_0 + TS = 8.75M + 0.9M = 9.65M$$

$$S = 9.65M - 3M = 6.65M$$

b) If you were to use the **WACC** method to value equity, would your answer be **greater, equal, or less** than your answer to part a? Explain briefly. No calculations are required.

It would be **greater** since the WACC approach thinks that leverage remains constant, which in this case means it thinks debt is increasing, which results in the WACC overestimating the tax shield of debt and consequently overestimating the value of equity.

6) (10 points, 15 mins) Firm A is comparable to firm B in that both their assets have the same systematic risk. B has a leverage of 1.3, a cost of debt of 3.5% and a systematic risk of equity $\beta_{S,B} = 1$. The risk-free rate is 3% and the expected return of the market portfolio is 8%. Corporate tax rate is 30%.

a) What is the **cost of unlevered equity** for firm A?

$$\text{from CAPM for B: } r_s = 3\% + 1(8\% - 3\%) = 8\%$$

Now deleverage for firm B:

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

→ r_0 for firm B = **5.86%**, which is also equal r_0 for firm A.

b) Firm A has a leverage of 0.2 and risk free debt. Expected cash flow to equity is \$100 in perpetuity. **What is the equity value of firm A?** Use the **flow to equity approach**.

Now releverage for firm A (where cost of debt for A is the risk free rate since A's debt is risk free)

$$r_s = r_0 + (1 - T_c)L(r_0 - r_B)$$

$$= 6.26\%. \text{ Now we can value } S_B = 100 / 6.26\% = 1,599$$

7) (15 points, 20 mins) There are no taxes for the question below. In case of default, assume a bankruptcy cost of 10% 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: 2 new bonds, each with face value \$2 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? **Firm value decreases because of the bankruptcy costs. Note: the cash was not invested in assets. It was just paid out. So the assets of the company did not change (other than a decreased asset value because of the bankruptcy costs). There is no tax shield of debt here because we assumed no taxes to start with.**

- b) Compute explicitly by how much the above operation affects **shareholder wealth**.

Previous value of equity: $[(0.5)(8-2)+0.5(5-2)]/1.05 = 4.29$

Step 1: Figure out the amount of money raised in the debt issuance for each bond:

$B = [0.5(2) + 0.5(2/6)(5)(1-0.1)]/1.05 = 1.67$ per bond

(2/6) represents the fractional claim for each bond on the value of assets in default.

The value of equity is now $0.5(8-6)/1.05 + 0.5(0) = 0.95$

The value of shareholder wealth is $0.95 + 2(1.67) = 4.29$ once you take into account the proceeds paid out as dividends from the debt issuance.

Thus, shareholder wealth has remained unchanged since it was previously 4.29 and is still 4.29. This is a complete coincidence. If the bankruptcy cost were anything but 10%, you would get a different result.

Alternatively, shareholder wealth decreases because of the bankruptcy costs, but increases because they are stealing value from the pre-existing bondholders. Previously the preexisting bond was risk free and was worth $2/1.05 = 1.90$. Its price went to 1.67. Shareholder wealth has increased by $(1.90 - 1.67) - 0.5(0.1(5))/1.05 = 0$. The second term is the PV of bankruptcy costs. Again, it is just a coincidence that the two effects exactly cancel out in this example. You needed to show your calculations to receive credit. You were not penalized for rounding issues.

- 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 ranked junior, then the preexisting bond would still be risk free, and so the only impact on shareholder wealth would be a decrease due to the bankruptcy costs.**

8) (5 points, 10mins)

- At $t = 0$, firm F has outstanding a 1-year risk free 5% coupon bond that has a face value and market value of 20M, and a 2-year risk free 5% coupon bond that has a face value and market value of 10M
- Working capital at time t is 10% of EBITDA at time t
- EBITDA is 90M at $t = 0$ and 100M at $t = 1$
- At $t = 1$ the firm will recognize a depreciation expense of 8M and will make a capital expenditure of 7M
- The tax rate is 30%

Preliminary step: $WC_0 = 10\%(90) = 9$, $WC_1 = 10\%(100) = 10 \rightarrow$ WC increased by 1

Compute the cash flow to equity at $t = 1$.

100	EBITDA
-20(0.05)	-interest expense
-10(0.05)	-interest expense
- 8	- depreciation
<hr/>	
90.5	= pretax income
-90.5(0.3)	- taxes
<hr/>	
63.35	net income
+ 8	+ depreciation adjustment
- 7	- cap ex adjustment
-1	- increase in WC
-20	-FV repayment for bond maturing at $t = 1$ adjustment
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43.35M	= cash flow to equity at $t = 1$

9) (20 points, 20 mins) True or False. Indicate “True” or “False” to the left of each statement below.
No explanations are required.

a) All else equal, the higher the tax rate, the higher the tax shield of debt and the lower the value of the firm. **True, the value of the firm is lower since there is less money to go to debt and equity.**

b) In the WACC with taxes approach you discount after tax unleveraged cash flows at the unleveraged cost of equity to get the value of the firm. **False, you discount it using the WACC.**

c) If company A has a cost of capital of 10% then a positive NPV project that has an 8% expected rate of return should not be accepted. **False. The point is that the cost of capital of the firm is not relevant if the project has a different risk profile. The project might have very low risk and so the 8% expected return could be more than enough to compensate for that project’s low risk.**

d) A project could have a negative NPV if all equity financed, but could have a positive APV once the tax shield of debt is accounted for if partially financed by debt. **True, since tax shield of debt added to a negative NPV could give you a positive APV.**

e) For a firm that has risk free debt, $WACC = r_0$ when taxes are the only market friction. **False. WACC would be lower than r_0 .**

f) For a firm that has risk free debt, $r_s = r_0$ when taxes are the only market friction. **False, r_s would be higher.**

g) A firm that accumulated prior operating losses that can be carried forward should be worth more than an otherwise identical firm that hasn’t accumulated those prior operating losses. (“Identical” means they have the same discount rate and the same pre-tax cash flows going forward.) **True. The prior losses allow the firm to pay less taxes going forward.**

h) Assuming no frictions, if you issue equity and put that money in the bank, the value of the firm has remained unchanged. **False. The value of the firm has increased. There are now more assets, and more equity. Preexisting shareholder wealth, however, has remained unchanged.**

i) Assuming taxes and bankruptcy costs are the only frictions, firm value will always decrease as you increase leverage. **False. Initially firm value will increase as debt is added since when debt is risk free (or not too risky) the tax shield of debt outweighs the bankruptcy costs.**

j) Assuming no frictions, if a company issues debt to repurchase shares, and assuming this increases earnings per share, stock price should increase. **False. Stock price would remain unchanged. The earnings would be riskier and have to be discounted at a higher rate. The two effects (higher expected EPS and higher discount rate) exactly cancel each other out.**

Finance 2 Formula Sheet

$$S + B = S_0 + TS$$

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

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

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

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

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

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