

Name: _____

Section # (circle one) 61 62 63 71

Professors Eisfeldt and Sapienza Finance II (441)

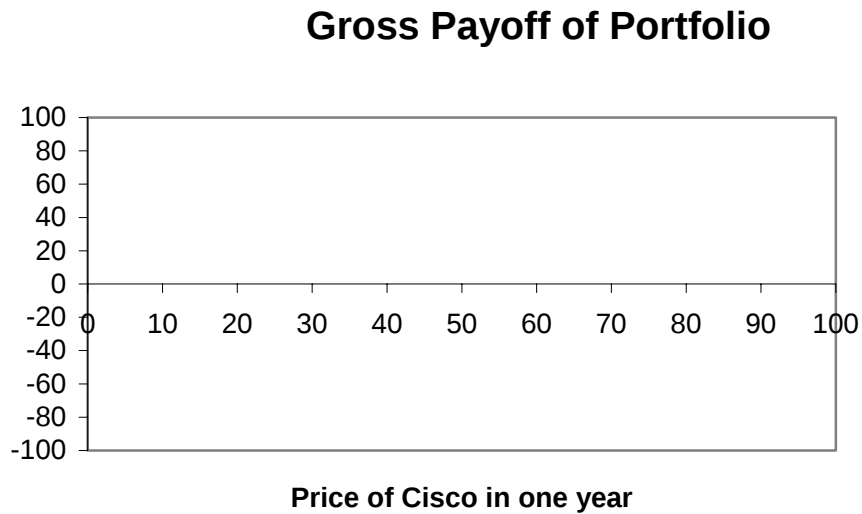
Corporate Finance Midterm: Spring 2004

- 1) Time limit. You have 1 hour and 40 minutes to complete the exam.
- 2) The exam is closed book and closed notes. You may not use any outside material. You may use a calculator. The last page contains a list of formulas taken from my lectures and the book.
- 3) Point totals for each question are specified in parentheses. There are 120 total points.
- 4) Circle your numerical answers. This makes it easier for me to find them. Show your work so I can give you partial credit. If you get stuck on the math, tell me what the correct answer should be based on your intuition.
- 5) Clear and concise answers will be rewarded.
- 6) As always, I expect you to abide by the **honor code**. I trust that no one will give or receive assistance which gives them an unfair advantage over other students. You may not speak to anyone who has not completed the exam about the exam.

Good Luck!

Problem 1

A) Draw the gross payoff for the following portfolio: buy a one year call option on Cisco with the strike price of 20 and sell a one year call option on Cisco with the strike price of 80. Make sure your diagram is clearly labeled. (20)



B) Do you think the above portfolio has a positive price? (Hint: do you think you should pay or be paid to hold the above portfolio?)

Why?(5)

C) Assume that the β on Cisco stock is 1.3 and the risk free interest rate is 2%. What can you say about the expected return you earn from shorting calls on Cisco stock? Be as specific as possible. (5)

Problem 2: Short Answers

A) IBM has \$16.986 Billion in Long Term Debt Outstanding. Assume that the promised return on this debt is 10%. The current one year treasury yield is 2%, and you may assume that this is a good proxy for the risk free rate at all horizons (i.e. the yield curve is currently flat.)

(i) Is IBM's debt risky? Explain. (5)

(ii) Is the risk in IBM's debt systematic, idiosyncratic, or do we not have enough information to tell? Explain. (5)

B) Last night you completed pro forma accounting statements for Hewlett Packard at the request of the CFO, Robert Wayman. However, this morning Robert asked you to revise the sales growth assumption downwards because Dell has announced that they will begin manufacturing and selling their own printers.

You will have a few days to revise the pro formas, but Robert is meeting HP's bankers today and would like an immediate answer as to what will happen to the projected bank loan reported in the pro formas. What will the lower sales growth assumption imply for the bank loan, or plug going forward? (i.e. how will the new plug estimate compare to the original?) Explain. (10)

C) The Nasdaq 100 index closed on Tuesday April 27th at \$1479.47. On that day, puts expiring **next month** with a strike price of \$1250 closed at a price of \$0.90

- (i) You have a large investment in the Nasdaq 100. One year from now, you would like to make sure you have a down payment for a condominium. You can insure that you can cover your down payment with the money you've invested in the Nasdaq 100 index if you insure your investment by purchasing puts with a strike price of \$1250 expiring in **one year**. Will this insurance cost you more, or less than \$0.90 per share of the index that you own? Explain. (7)

- (ii) Does the insurance strategy in part (ii) eliminate your upside potential from possible increases in the Nasdaq 100 index? (8)

Problem 3

Pubs Inc. owns and operates pubs under various names including "Chitown Greenbeer". The firm is currently financed with both debt and equity. The firm is 10% debt and the market value of the firm's debt is \$2M. The firm's equity is less risky than the market. The equity beta is 0.8. The current riskfree rate is 5.7%. The firm is considering expanding by building another 14 pubs. The market risk premium is 8.5%.

A) Pat O'Hara is a big fan of Chitown Greenbeer. He has all of his wealth invested in the stock of Pubs Inc. Is it possible for Mr. O'Hara to choose a new portfolio which is less risky, but still has the same expected return? If the answer is yes, what would the portfolio consist of? Be specific. If the answer is no, why not? Be specific. (6)

B) Pubs Inc.'s debt is due in one year and has a promised rate of return equal to 5.7%. What discount rate should be used to discount the cashflows to Pubs Inc.'s expansion project? Explain completely. (8)

C) Pubs Inc.'s expansion plans will require a capital investment of \$5M. To finance the expansion, Pubs Inc. has decided to sell \$7M worth of equity. Covenants in Pubs Inc.'s current debt prohibits it from building additional pubs. Thus to complete the planned expansion, the debt must first be repurchased. Will the expected return on Pubs Inc.'s equity be higher or lower after the expansion compared to before? Explain. (6)

Problem 4

You are considering the purchase of a vacant lot, upon which you will build an apartment building. You have obtained a commitment from a local builder, good for one year, to construct a three flat building on the lot for \$650,000 in construction costs.

There are two possible states of the world. In the good state, which will occur with 25% probability, demand for housing will be high and the *perpetual* after-tax free cash flow (after all operating and maintenance expenses) generated by the apartment will be \$90,000/year. In the bad state, demand will be low and the *perpetual* free cash flow will be only \$40,000/year. Assume that revenues begin one year after construction costs are incurred. The level of demand will be the same for all years and you will be able to tell whether demand is high or low after one year from observing housing sales in the area. Use a discount rate of 8% in all calculations.

A) Assume you have already purchased the land. What is the NPV at time 1 of building the apartment building at time 1 if demand turns out to be high? (6)

What is the NPV at time 1 of building the apartment building at time 1 if demand turns out to be low? (6)

What is the NPV at time 0 of the apartment building project if you decide to start construction immediately (at time 0)? (6)

B) Since you are not the only interested purchaser, the seller of the land has decided to auction off the vacant lot. What is the maximum amount you would bid? Explain the intuition for your answer. (12)

C) Suppose that instead of \$90,000 or \$40,000, after-tax cashflows are either \$210,000 (in the good state) or \$0 (in the bad state), again with 25% and 75% probability. Expected cashflows haven't changed. Would you bid a lower or higher amount for the land? Assume that all other revenues and costs are the same. I am looking for an intuitive answer only. (5)

Facts and Formulas

Value of a perpetuity:

$$V_{\text{cashflows}} = \sum_{t=1}^{\text{infinity}} \frac{C}{(1+r)^t} = \frac{C}{r}$$

Value of a growth perpetuity:

$$V_{\text{cashflows}} = \sum_{t=1}^{\text{infinity}} \frac{C}{(1+r)^t} = \frac{C}{r-g}$$

Value of a T year annuity:

$$V_{\text{cashflows}} = \sum_{t=1}^T \frac{C}{(1+r)^t} = \frac{C}{r} - \frac{C}{r(1+r)^T}$$

These formulas hold for returns as well as for betas.

Asset β : Since $A=D+E$

$$\beta_{\text{Assets}} = \beta_{\text{Debt}} \frac{\text{Debt}}{\text{Debt} + \text{Equity}} + \beta_{\text{Equity}} \frac{\text{Equity}}{\text{Debt} + \text{Equity}}$$

If there are two types of assets:

$$\beta_{\text{Assets}} = \beta_{\text{Asset1}} \frac{\text{Asset1}}{\text{TotalAssets}} + \beta_{\text{Asset2}} \frac{\text{Asset2}}{\text{TotalAssets}}$$

Equity β :

$$\beta_{\text{Equity}} = \beta_{\text{Asset}} + \frac{\text{Debt}}{\text{Equity}} (\beta_{\text{Asset}} - \beta_{\text{Debt}})$$

Capital Asset Pricing Model:

$$E[r_{\text{project}}] = r_{\text{risk free}} + \beta_{\text{project}} E[r_{\text{market return}} - r_{\text{risk free}}]$$

Payoff to a call option:

$$\begin{aligned} \text{Payoff} &= \text{Max} \{ 0, \text{Price of Stock} - \text{Strike Price} \} \\ &= \text{Max} \{ 0, S_t - X \} \end{aligned}$$

Payoff to a put option:

$$\begin{aligned} \text{Payoff} &= \text{Max} \{ 0, \text{Strike Price} - \text{Price of Stock} \} \\ &= \text{Max} \{ 0, X - S_t \} \end{aligned}$$

Put-call parity:

$$S + P_X = C_X + \text{PV}(X)$$

Balance Sheet Relation:

$$A=L+E$$

Balance Sheet/Income Statement Link:

$$RE_t = (NI_t - \text{Div}_t) + RE_{t-1}$$

Scratch Sheet #1

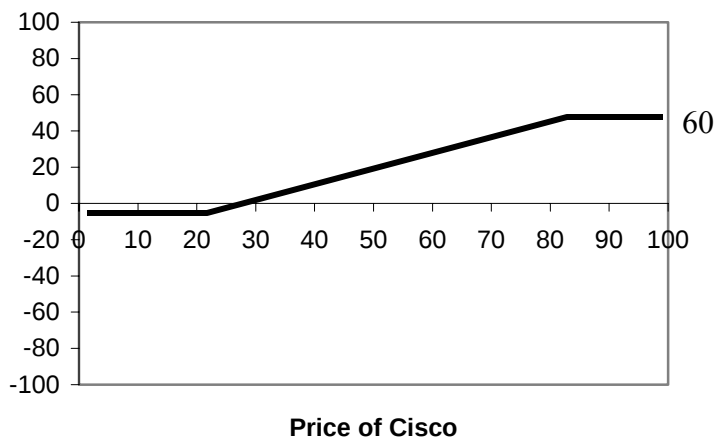
Scratch Sheet #2

Sketch of the solutions

Problem 1

- A) This portfolio contains two options, so your final picture will contain two kinks – one at 20 and the other at 80. Below 20, both options are out of the money. Between 20 and 80 the long position has a payoff equal to the stock price minus 20, the short position has zero payoff. Above 80, the short position becomes relevant. For every dollar the price of Cisco increases above 80 you will gain 1 dollar with the long position and lose one dollar with the short position. This is called a bull spread. Holders of bull spreads benefit from price increases.

Gross Payoff of Portfolio



- B) The portfolio always has a positive payoff. This portfolio has a positive price, i.e. you should be paying in order to be able to buy the portfolio. If you could get paid to hold this portfolio, you could make a riskless arbitrage trade by doing so (you get money today and the worst that can happen tomorrow is that you make nothing.)
- C) The expected return on shorting calls is less than the risk free rate. The beta of Cisco is positive – its stock price rises in booms and falls in recessions. Now look at the payoff of the short position. When Cisco's stock price rises, the short position loses money (in booms). Thus the beta of shorting a call is negative. Thus, the expected return on shorting calls is less than the risk free rate.

Problem 2

A)

(i) IBM's debt is risky. It has a promised return greater than the risk free rate which means it must default with positive probability. We don't know if the risk is systematic or idiosyncratic since we only know the *promised*, not the expected return.

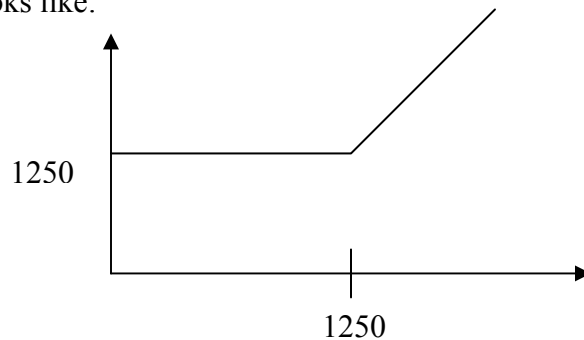
(ii) We don't know whether any of this risk is systematic, since we don't know the bond's beta or how its *expected return* compares to the risk free rate. The risk could be systematic, idiosyncratic, or both.

B) The new plug will be bigger. The lower sales growth number will mean lower net income, which will mean lower retained earnings and a bigger plug in order to maintain $A=L+E$.

C)

(i) The insurance requires buying puts which expire in one year. We can't say whether these puts will be more or less expensive than the puts expiring at the end of the month. It may cost more or less than \$0.90 per share of the index that we own. The time value of information means that the longer expiration put will be more expensive, but the negative time value of money for the put makes longer expiration puts less expensive.

(ii) We retain our upside. That's why this type of hedge is relatively expensive. Our payoff looks like:



Problem 3

Capital budgeting and Pubs Inc.

A) It is possible to lower the risk of the portfolio and maintain its expected return, only if the portfolio contains idiosyncratic (firm specific, diversifiable) risk. Since Pat O'Hara owns a single stock, his portfolio contains all the idiosyncratic risk of Pubs Inc. This is the risk that consumers like or do not like their pubs. To maintain the same expected return, we need a portfolio with a beta of 0.8. If you invest 80 percent of Pat O'Hara's assets in the market and 20% of his assets in T-bills (riskfree assets), the beta of his portfolio will still be 0.8 and the expected return will remain equal to 12.5. Since the idiosyncratic risk of the portfolio has been eliminated, the portfolio is less risky. Notice, you have not eliminated any of the systematic risk of the portfolio. You can't do this without lowering the expected return on the portfolio. Selling a portion of the Pubs Inc. stock and investing the proceeds in other stocks with a β of 0.8 is a step in the correct direction. It will maintain the expected return and eliminate some, but not all of the idiosyncratic risk. Remember only a fraction of firms have equity β as low as 0.8 — certainly less than half.

B) The question is asking for the project discount rate. Since the project is an expansion of the firm's current assets, the project beta is the same as the firm's asset beta. The firm is 10 percent debt. Since the debt is worth \$2M, the market value of the firm is \$20M. The debt has a promised rate equal to the risk free rate. This implies the debt is riskfree and therefore has a zero beta. The equity beta is 0.8. The asset beta is therefore 0.72.

$$\beta_{\text{Assets}} = \beta_{\text{Debt}} \frac{\text{Debt}}{\text{Debt} + \text{Equity}} + \beta_{\text{Equity}} \frac{\text{Equity}}{\text{Debt} + \text{Equity}} = 0 * 0.1 + 0.8 * 0.9 = 0.72$$

Cashflows to the expansion project should therefore be discounted at 11.8 percent.

$$E[r_{\text{project}}] = r_{\text{risk free}} + \beta_{\text{project}} E[r_{\text{market return}} - r_{\text{risk free}}] = 5.7 + 0.72(8.5) = 11.8$$

C) The expected return on Pubs Inc.'s equity will be smaller after the expansion compared to before. The expected return on Pubs Inc.'s equity will rise or fall only if the equity beta changes. When the Pubs Inc. spends \$5M on the expansion, the type of assets which the firm owns and thus the firm's asset beta will not change. They are investing in the same business. The firm's capital structure will change. Initially the firm was levered — it had debt in the capital structure. After the expansion, equity issue, and debt repurchase, the firm will be all equity. Since its leverage went to zero, the equity beta will fall from 0.8 to 0.72. The expected return therefore falls.

Problem 4

A) If demand is high, the value of the cashflows is the value of a perpetuity where $(C/r) = (90K/0.08) = 1125K$. The construction costs are 650K, so the value of building the apartments is 475K.

If demand is low, $(C/r) = (40K/0.08) = 500K$. The construction costs are 650K, so the value of building the apartments is -150K. Since we don't take negative NPV projects, the value is zero if we know demand.

If we build immediately, we get an NPV of:

$$(0.25)*475 + (0.75)*(-150) = 6.25K$$

B) We can either build now or in one year.

If we build now, the project is worth 6.25K.

If we wait one year, we could either find out that demand is high or low. If it is low, we won't build. The NPV of the project if we wait one year is:

$$\frac{(0.25) * (475) + (0.25) * 0}{1.08} = \frac{118.75}{1.08} = 109.95$$

Thus, we will wait a year, and the maximum we would bid for the land is \$109,950.

C) If the variance of the cashflows increased, the option becomes valuable. Therefore, information becomes valuable and the "option" is valuable. In this case, the value of the project becomes higher if you wait a year and learn about the level of demand, and thus increases the value of the project overall.