Name: (Print!)_________________

Finance II (441) Professor Sapienza

Corporate Finance Midterm: Fall 2007

1) Time limit. You have 1 hour and 30 minutes to complete the exam.

2) The exam is closed book and closed notes. You may use one page of notes (both sides). You may also use a computer or a calculator.

3) Point totals for each question are specified in parentheses. There are 120 total points.

4) Please circle your numerical answers. This makes it easier for me to find them. If you get stuck on the math, tell me what the correct answer should be based on your intuition. Incorrect numerical answers based on the correct logic will receive partial credit. Correct numerical answers without explanations will not be given full credit.

5) Unless the question specifies otherwise, there are no taxes or transactions costs.

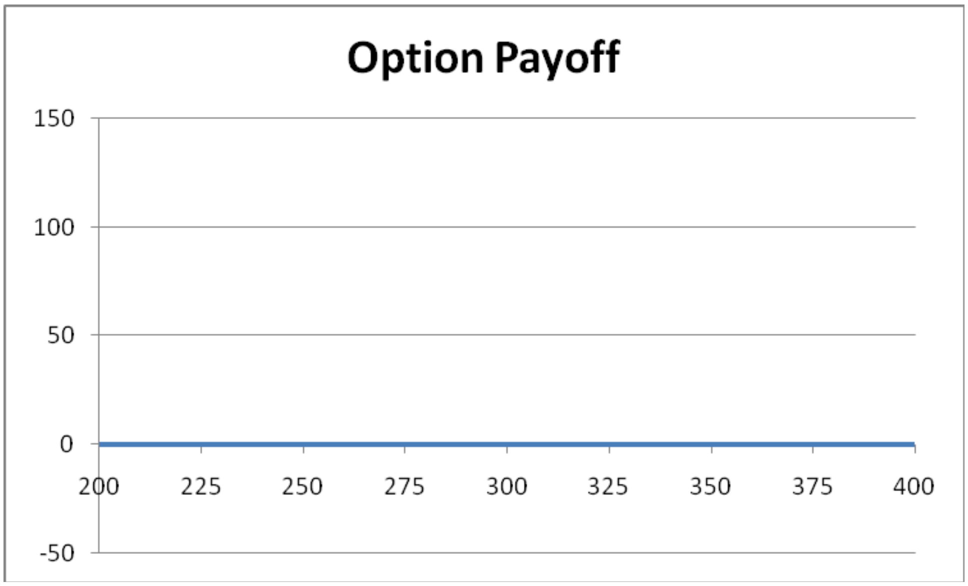
6) Statements by you that are true, but do not answer the question, will not raise your score.

7) Sharing any written or verbal account of this exam with any student who has not yet taken the exam is a violation of the honor code.

8) Write your answers on the exam.

Question	Score
1 (30)	
2 (30)	
3 (40)	
4 (20)	
Total (120 possible)	

(1) (A) Draw the **gross payoff** diagram for the following portfolio: buy one put option on copper with one year to expiration and a strike price of $300 plus sell one put option on copper with one year to expiration and a strike price of $250. Copper is currently trading for $320 and the current risk-free rate is 7 percent. The put with a strike price at $300 has a price of $10 while the put with a strike price at $250 has a price of $2. Make sure your diagram is clearly labeled. [10 points].



(B) How must an investor's beliefs differ from the market's beliefs for the portfolio described in A) to be a good investment? Be specific. [10 points]

(C) The portfolio described in (A) has an expected return of 10%. If you have only public information, what can you say about the beta of copper? Be specific. [10 points]

(2) Phillip Morris has paid a steady and consistent dividend over many years. Their dividend is paid quarterly and was $0.75 per share in the second quarter of the year. It was announced and paid in July.

(A) On October 1st, after the market closed, Phillip Morris announced that their quarterly dividend would rise to $1.25 per share. The dividend change was unexpected. The stock closed on the 1st at a price of $93.75 and opened on October 2nd at a price (cum dividend) of $95. How did the dividend announcement change the market's expectation of dividends to be paid in 2008 and beyond? Explain. (10)

(B) Phillip Morris's stock went ex-dividend on October 10th. The stock price closed on October 9th at \$97.00 and opened on October 10 at \$95.75. How did the market's expectation of future cash flows change when the stock went ex-dividend? Explain. (10)

(C) Now imagine that Phillip Morris has \$100M invested in one year T-bills. Each year this money is reinvested in T-bills. If earnings are below expectations and Phillip Morris's managers cut investment in T-bills to pay a high dividend, this will change the wealth of shareholders as the Modigliani-Miller theorem requires investment to be held constant. Consequently, cutting investment back from the optimum level destroys the wealth of Phillip Morris shareholders. True, False, or Uncertain? Explain. (10)

(3) Ben and Jerry's is a publicly held company that has two primary businesses, ice cream manufacturing and ice cream distribution. Ben and Jerry's assets have a total market value of \$180 million of which 70% are manufacturing and 30% are distribution assets. The beta for the manufacturing assets is 0.47 and Ben and Jerry's equity beta is 0.75. Ben and Jerry's only liability is \$20 million of long term debt with a beta of 0.3. The risk free rate is 5%. The current share price is \$22.86 and there are 7 million shares outstanding.

(A) What is Ben and Jerry's overall asset beta? (10)

(B) Ben and Jerry's is considering selling the distribution assets and investing the money in T-bills (T-bills are short-term government bonds). If they do this would the firm equity beta be higher, lower or the same? Explain. I do not want a numerical answer. (10)

(C) Jeremy’s Microbatch Ice Cream, Inc., a privately held firm, markets and sells super-premium ice cream. Unlike Ben & Jerry's, Jeremy's Microbatch does not manufacture their own ice cream (it has only distribution assets). Jeremy's Microbatch will do an IPO this week. Suppose you are trying to value Jeremy's Microbatch using information on Ben and Jerry's. What discount rate should be used to value the total free cash flow of the firm? Assume that the market risk premium is 8.4%. (10)

(D) Jeremy Microbatch has a leverage ratio of 35% (35% debt and 65% equity) and its debt has a beta of 0.25. What discount rate should be used to value the cash flows to Jeremy Microbatch’s equity holders? (10)

(4) Airfree Inc. is a high technology company that specializes in state of the art satellite connections. At the end of 2007, Airfree is considering buying a patent on a production process that would enable new satellite connections for home PCs. The technology provides faster and more efficient connections than the current cable and DSL technologies. The technology will produce the following cash flows: If Airfree initiates the project at the end of 2007, the cash flow at the end of 2008 will be $10 million for sure. At the end of year 2008, regardless of whether they make the investment now or wait until later, Airfree will know with certainty whether the technology produces a perpetual annual cash flow stream of $15 million (the good scenario) or $2.5 million (the bad scenario) in year 2009 and thereafter. Airfree currently believes that the two perpetual cash flow streams are equally likely. Airfree can start the project at the end of any year with an initial one-time investment of $100 million. The appropriate discount rate for the project is 5%.

(A) What is the maximum price Airfree Inc. should be willing to pay to buy the patent? (10)

(B) A material science professor at MIT has just developed a new material that could considerably improve the technology of satellite connections. By using this new technology Airfree Inc. estimates that it can increase the cash flow in the good scenario by 10% from $15 million to $16.5 million. Using this technology the cash flow in the bad scenario will not change. However, if the technology is adopted the initial cost of the project will increase by 15% from $100 million to $115 million. One engineer at Airfree Inc. points out that the additional cost of this technology exceeds the expected additional revenue. Thus, he recommends not buying the new technology. Do you agree? Explain and show all calculations. (10)

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: $V_{\text{cashflows}} = \frac{C}{r - g}$

Value of a T year annuity: $V_{\text{cashflows}} = \sum_{t=1}^{T} \frac{C}{(1+r)^T} = \frac{C}{r} - \frac{C}{r(1+r)^T}$

Asset β: Since A=D+E $\beta_{\text{Assets}} = \beta_{\text{Debt}} \frac{\text{Debt}}{\text{Debt+ Equity}} + \beta_{\text{Equity}} \frac{\text{Equity}}{\text{Debt+ Equity}}$

If there are two types of assets: $\beta_{\text{Assets}} = \beta_{Asset1} \frac{Asset1}{TotalAssets} + \beta_{Asset2} \frac{Asset2}{TotalAssets}$

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

Expected rate of return on equity: $r_{\text{equity}} = r_{\text{assets}} + \frac{D}{E} (r_{\text{asset}} - r_{\text{debt}})$

Capital Asset Pricing Model: $E[r_{project}] = r_{\text{risk free}} + \beta_{project}\, E[r_{\text{market return}} - r_{\text{risk free}}]$

Equations and Facts, continued

Payoff to a call option:

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

Payoff to a put option:

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

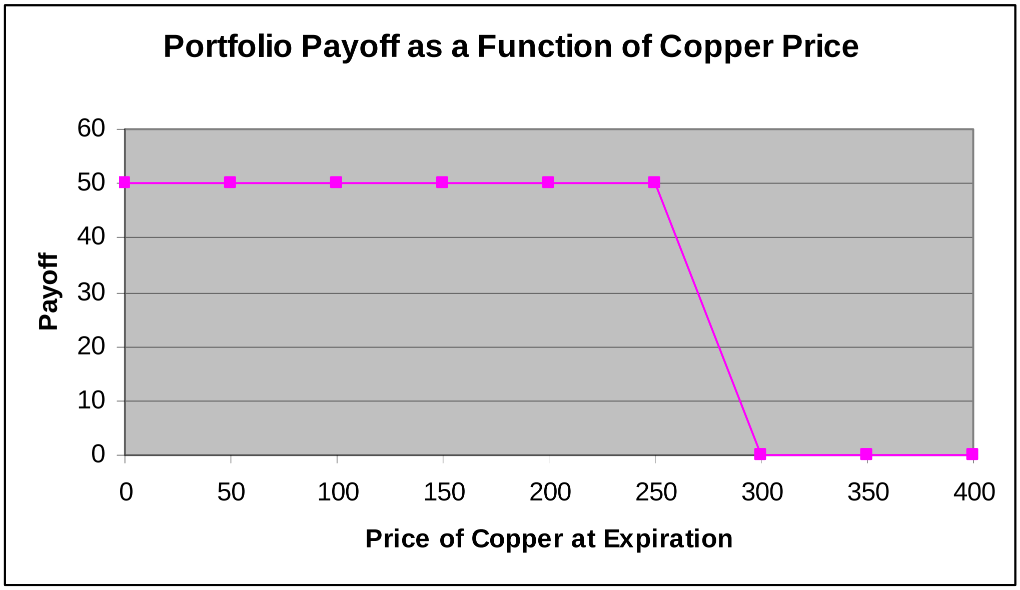
Payoff of a Forward or Futures Contract:

Long: $(CV_t\text{-}X)$
Short: $(X\text{-}CV_t)$
where X is the futures price and CV_t is the commodity value at date t.

Fall 2007 Midterm Exam
Sketch of the Solution

(1) Options and payoff diagrams.

(A) The payoff to the portfolio is 50 from \$0 to \$250, 300-P from 250 to 300, and zero for underlying prices greater than \$300.



(B) The speculator must believe that copper will decline in value. However, as the position limits the downside protection at \$50, the speculator must also believe that copper won't drop much below \$250.

(C) The portfolio of puts must have a positive beta if it has an expected return above the risk free rate. As a consequence, copper must have a negative beta as the payoff on the portfolio of puts is negatively correlated with the payoff of a long position in copper.

(2) Phillip Morris and dividend signaling.

(A) The stock price is the discounted value of all future cash flows to equity holders (dividends). Thus the stock price will change when the market's expectation of cash flows changes. When Phillip Morris announced an unexpected dividend increase of 50 cents, the stock price jumped up by \$1.25. This is because equity holders expected to get an additional 50 cents in a week. The fact that the stock price went up by \$1.25, meant that the market expects future cash flows to equity holders to increase by \$0.75 in present value. The dividend announcement increased the market's expectation of dividends to be paid in 2008 and beyond.

(B) The ex-dividend day does not convey information to the market. The dividend payment (50 cents) was already known to the market. The market learned the dividend payment on the 1st of October when the dividend was announced. Investors purchasing the stock on the 10th will not receive the dividend. Investors purchasing the stock on the 9th will receive the dividend and thus are willing to pay $1.25 more for the stock. The stock price thus falls by the dividend between the 9th (the cum-dividend day) and the 10th (the ex-dividend day). The fact that the stock price fell by exactly the amount of the dividend is consistent with the market making no changes in its expectation of future cashflows to equity holders (dividends).

(C) In this example, by paying a high dividend the firm does not make an investment in T-bills. Since this is a zero NPV investment, the firm's value does not change. Thus the firm is able to maintain a high dividend, even when earnings are low, by selling off its T-bills. When the dividend is actually paid, the value of the firm will fall by the size of the dividend. In the lecture, I argued that the value of the firm fell when investment was cut because the investment being cut was a positive NPV investment. Changes in investment will not affect the firm if the firm increases or decreases investment in zero NPV projects. For the firm’s value to change when investment is changed, the project must have a positive or negative NPV Investments in T-bills are a zero NPV investment unless you have inside information on real rates and inflation over the next year. It is safe to assume that for most firms, investment in T-bills is a zero NPV investment.. Cash or marketable securities can provide a buffer between volatile earnings/cash inflows and the firm's desired investment. This is unimportant when financial markets are perfect. We will discuss the effect of imperfect financial markets later on in the course.

(3) (A) Ben and Jerry's overall asset beta must equal to the weighted average of the debt and equity beta.

$$\beta_{assets} = \beta_{Debt} \frac{Debt}{Debt + Equity} + \beta_{Equity} \frac{Equity}{Debt + Equity} =$$

$$= 0.3 \frac{20}{20 + 160} + 0.75 \frac{160}{180} = 0.70$$

(B) In this scenario, the assets of Ben and Jerry’s will change. In fact, 30% of the firm’s assets will now be invested in riskfree securities. Since the firm’s assets are now less risky –the asset beta has fallen – the equity beta will be lower. Ben and Jerry’s will have the same financial leverage as before, but less business risk.

(C) Because Jeremy's Microbatch has only distribution assets, its overall asset beta must equal Ben and Jerry’s distribution asset beta. Ben and Jerry’s distribution asset beta is:

$$\beta_{assets} = 0.3\beta_{Distribution} + 0.7\beta_{Manufacturing}$$

$$0.70 = 0.3\beta_{Distribution} + 0.7 * (0.47)$$

$$\beta_{Distribution} = 1.23$$

Using a beta of 1.23, the expected rate of return for distribution assets can be calculated:

$$r_{Jeremy\_Microbach} = 0.05 + (1.23)(0.084) = 0.1533$$

(D) First we calculate the expected return on debt for Jeremy's Microbatch:

$$r_{debt} = 0.05 + (0.25)(0.084) = 0.071$$

To discount cashflows to equityholders we need the expected return on equity. Therefore,

$$r_{equity} = r_{assets} + \frac{D}{E}(r_{assets} - r_{debt}) = 0.15 + \frac{.35}{.65}(0.15 - 0.071) = 0.19$$

(4) (A) The maximum price Airfree Inc. should be willing to pay is \$95.24 Million. This is the profit that Airfree expects to make if the company waits for one year before undertaking the project. If the company waits for one year, it will loose the first year initial \$10 million cashflow. However, it will gain the information on the state of competing technologies and therefore will be able to invest only if the perpetual stream of cashflows is \$15 million. The profit when the cashflow is \$15 million is:

$$\frac{(\$15million / .05) - \$100million}{1.05} = 190.48$$

Since this event occurs only with probability .5, the expected return is **\$95.24million**. Please note that starting the project right away is not a preferred alternative. In fact the expected profit under this alternative would be:

$$\frac{(.5)(\$310million) + (.5)(\$60million)}{1.05} \quad \$100 = \$76.19million$$

(B) Disagree. The expected return from the project will decrease with the new technology, only if the project is undertaken right away. But this is not the right decision. If the firm waits before undertaking the project, the new technology will increase the expected annual cash flow by more than \$7 million, increasing the value to **102.38**