Name: _____

Finance II (441) Professors Matsa

Corporate Finance Midterm: Practice Exam B

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 not use any outside material. You may use a calculator. The last page of the exam contains a list of formulas taken from my lectures and the textbook. These formulas may or may not be useful for solving the exam.

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. 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.

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 about the exam to anyone who has not yet completed it.

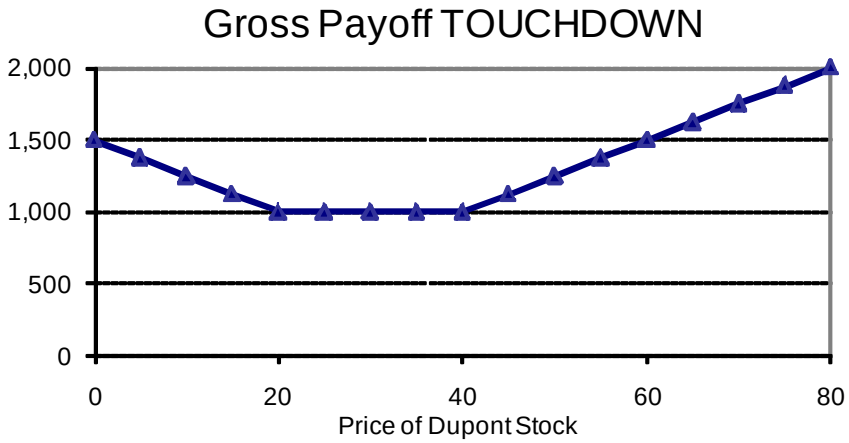
7) The characters and events depicted in this exam are fictitious. Any similarity to actual persons or firms, living or dead, is purely coincidental.

Good Luck!

Midterm Exam

Question	Score
1 (40)	
2 (20)	
3 (25)	
4 (35)	
Total (120)	

1) Your wealthy aunt has given you a security called a TOUCHDOWN for your birthday. The rest of your vast financial assets are invested in a market index fund. The TOUCHDOWN will make a single cash payment in one year. The cash payment you will receive is graphed below as a function of Dupont's stock price. Dupont is an industrial chemical firm with divisions ranging from agricultural products to paint coatings. The current one-year risk-free T-bill is yielding 80 basis points.



A) Tell me how you could construct the TOUCHDOWN payoff using only Dupont stock, t-bills, calls and puts on Dupont stock. Explain completely. (15)

B) Dupont's major competitors are Dow Chemical, Syngenta, and Monsanto. According to the equity analyst at UBS, Monsanto is suing Dupont over its use of Monsanto's fertilizer Roundup in a large number of Dupont's products. This would explain the recent rise in the volatility of both Dupont's and Monsanto's equity. How does this increase in volatility alter the expected return on your TOUCHDOWN security? Explain completely. (10)

C) How does the increase volatility alter the value of your TOUCHDOWN security? Explain complete. (5)

D) The term structure of interest rates is very steep. Concerned about rising inflation expectations, the central bank announced a reduction in the money supply. The one year T-bill rate jumped to 1.9%. Dupont's stock price did not change when the central bank made its announcement. How would this change in short term interest rates affect the value of your TOUCHDOWN? Explain (10)

2) Short Discussion Questions

A) Last month, Appleton Electric, a manufacturer of electrical construction products, took advantage of federal stimulus tax incentives and spent $10M to build a new environmentally friendly production facility in Appleton, WI. The law temporarily allows such investment to be written off (depreciated) in 3 years instead of 12 years. Analysts estimate that this investment has an NPV of $6M. Making the investment increased the book value of Appleton's equity. True, false, or uncertain? Explain. (10)

B) The new investment has a higher β than Appleton's current assets. Will the announcement that Appleton was making this investment raise the market price of Appleton Electric's equity? Explain completely. (10)

3) The term structure of interest rates aggregates market participant's beliefs about the future course of interest rates. Currently the one year government bond (T-bill) is yielding 0.8% and the ten year government bond is yielding 3.6%. These are par bonds meaning they currently sell for face value ($1000).

A) One fixed income investment strategy is to purchase the ten-year government bond and sell it next year after having collected the coupon payment for the year. What can you tell me about the expected return on this strategy? Be as specific as possible. (10)

B) How much is the price of the ten-year bond expected to rise or fall over the next year? Explain as completely as possible. (10)

C) If the economy does well and the stock market is up significantly, will the return on your one-year investment in a ten-year government bond be above or below your answer to A)? Explain completely. (5)

4) Fishman Catering hosts the birthday party for Dean Jacobs each year at the Allen Center. The project requires an investment of $800 each year and generates an expected cash flow of $1600 the following year. The actual cash flow can be as high as $2,000 and as low as $1200. It will vary for idiosyncratic reasons (more out of town alumni come when his birthday falls on a week day) and systematic reasons (more alumni come when the economy is doing well and they have more discretionary income). The success of this year's birthday celebration is uncorrelated with next year's birthday celebration. The project is taken every year. The discount rate for the project is 10% and is based on a risk-free rate of 0.8% and a project β of 1.08. Fishman catering has 800 shares outstanding and no debt.

A) After taking the investment project this year and paying out all free cash flow as a dividend, what do you expect the value of Fishman Catering's equity to be? This is the number of shares times the price per share. (5)

B) Although the economy was poor this year and the stock market fell, a surprisingly large number of alumni were able to attend Dean Jacob's party. Thus the profits were higher than expected at $1,900. After investing the required $800, the remaining cash will be paid out as a dividend. When the dividend is announced, how much (if any) will the price Fishman Catering equity rise or fall? Explain completely. Assume that none of the shareholders attended this year's birthday party, so they are not aware of this year's profits prior to the dividend announcement. (10)

C) When Fishman Catering announced the higher earnings, they also announced that they would not be paying out the full 1,100 as a dividend. They are going to retain 760 to invest in a new side business and pay out the remaining cash. They are printing birthday T-shirts for next year's party. The T-shirts are pre-ordered and paid for by alumni so Fishman Catering is guaranteed a payment of 800 next year on their investment. How does the return on this project compare to Fishman Catering's costs of capital, i.e. the discount rate they use for evaluating their other projects? Explain briefly. (5)

D) By how much does reducing the dividend payment to shareholders by 760 and investing in the new (T-shirt) project change the wealth of Fishman Catering's shareholders? Explain completely. (15)

Facts and Formulas

Value of a growing perpetuity:

$$V_{\text{cashflows}} = \sum_{t=1}^{\infty} \frac{C_1(1+g)^{t-1}}{(1+r)^t} = \frac{C_1}{r-g}$$

Value of a growing annuity:

$$V_{\text{cashflows}} = \sum_{t=1}^{N} \frac{C_1(1+g)^{t-1}}{(1+r)^t} = \frac{C_1}{r-g}\left(1-\left(\frac{1+g}{1+r}\right)^N\right)$$

Asset β:

If Assets = Debt + Equity, then

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

Free Cash Flow to Assets:

FCF = Revenue – Costs – Depreciation – Taxes
+ Depreciation – Capital Expenditures – ΔNWC

Capital Asset Pricing Model:

$$r_A = r_{\text{risk free}} + \beta_A \, \text{E}[\, r_{\text{market}} - r_{\text{risk free}} \,] + \varepsilon$$
$$\text{E}[\, r_A \,] = r_{\text{risk free}} + \beta_A \, \text{E}[\, r_{\text{market}} - r_{\text{risk free}} \,]$$
$$\text{E}[\, r_{\text{market}} - r_{\text{risk free}} \,] = 8.5$$
$$\text{E}[\, r_{\text{long-term treasury}} - r_{\text{risk free}} \,] = 1.1$$

Payoff to a call option:

$$\text{Payoff} = \text{Max}\{\, 0 \,,\, S_t - X \,\}$$

Payoff to a put option:

$$\text{Payoff} = \text{Max}\{\, 0 \,,\, X - S_t \,\}$$

Solutions to Corporate Finance Midterm: Practice Exam B

1) Dupont TOUCHDOWN[1]

A) The TOUCHDOWN is constructed by (*i*) buying a zero-coupon T-Bill with a face value of 1,000 and one year to maturity, (*ii*) buying 25 puts on Dupont with a strike price of 20 and one year to maturity, and (*iii*) buying 25 call options on Dupont with a strike price of 40 and one year to maturity.[2] To see why, consider the payoff of each piece of the portfolio. If you purchase a zero-coupon T-Bill with a face value of 1000 and one year to maturity, you would receive 1,000 next year no matter what the Dupont stock price is. Next, we need to add a security that will increase our payoff if the price of Dupont falls below 20 a share and will pay 500 if the stock price drops to 0. Buying 25 put options on Dupont stock with a strike price of 20 and one year to maturity will generate this part of the payoff. When the price of Dupont stock is 0, each put will have a payoff of 20, and so 25 will have a total payoff of 500. The third step is to create the payoff above 1,000 when the price of Dupont stock is above 40. You need to buy 25 call options on Dupont stock with a strike price of 40 and one year to maturity. When the price of Dupont stock is 80, each call will payoff 40, and so 25 calls will have a total payoff of 1,000. This plus the 1,000 from the T-bill gives you a payoff of 2,000 when the stock price is 80.

Based on put-call parity, we know that there are also other combinations of Dupont stock, T-bills, and calls and puts on Dupont stock will also generate the same gross payoff. For example, you can buy 50 shares of Dupont stock, buy 75 put options on Dupont stock with a strike price of 20 and one year to maturity, sell 50 call options on Dupont stock with a strike price of 20 and one year to maturity, and buy 25 call options on Dupont stock with a strike price of 40 and one year to maturity. This combination of securities gives the same gross payoff as the TOUCHDOWN.

B) Because you and other investors in Dupont are well diversified, changes in idiosyncratic risk do not affect the expected return on Dupont stock or on derivatives that depend upon Dupont stock. The lawsuit and the volatility are idiosyncratic, and so the expected return on the TOUCHDOWN does not change with the rise in idiosyncratic risk.

C) The increase in idiosyncratic volatility will raise the value of the TOUCHDOWN. The TOUCHDOWN is long 25 calls and long 25 puts. Since both calls and puts increase in value when volatility goes up, this means the value of the TOUCHDOWN will rise with the increase in volatility.

We know from part B that the discount rate does not change. The increase in volatility will increase the expected cash flow to the TOUCHDOWN. With higher volatility is it more likely that the stock price will be above 40 (and the payoff above 1,000) and it is more likely the stock price will be below 20 (and the payoff above 1,000). Because the expected cash flow is higher and the discount rate does not change, the value of the TOUCHDOWN will rise.

[1] Why "Touchdown"? Touchdown is the name of Roundup's main competitor, which is produced by Syngenta [http://www.syngenta.com/en/products_brands/touchdown_page.html]. I think there may also be a football reference.

[2] It is important that the coupon rate was zero, otherwise the T-bill would pay off 1,000(1+0.008) next year, not 1,000. It is also important to specify 25 calls and 25 puts. If you bought one call and one put, then your payoff would have been 1,040 when the stock price was 80 (not 2,000) and 1,020 when the stock price was 0, not 1,500.

D) The increase in the risk-free rate decreases the value of the TOUCHDOWN. The total value of a TOUCHDOWN is equal to the sum of the values from the individual components. You need to look at the how the values of the individual components of the TOUCHDOWN change when the risk free rate rises. First, the T-bill. The value of the T-bill falls (from 992.06 to 981.35) when the discount rate increases. Second, the calls. The increase in the T-bill rate, lowers the present value of the strike price and thus increases the value of the call. Remember, you pay the strike price with a call option. The time value of delaying payment is greater (the PV of the payment is smaller) when the risk-free rate rises. Third, the puts. The increase in the risk-free rate lowers the present value of the strike price, and thus decreases the value of the put. Remember, you receive the strike price with a put option. Thus the value of the T-bill falls, the put value falls, and the call value rises.

Which of these effects dominate?[3] The risk-free rate going up decreases the value of the T-bill by more than it increases the value of the call options. We know this because, for any possible realized price of Dupont stock next year, the risk-free rate going up decreases the value of the T-bill by the same amount or more than it increases the value of the call options. If the call options end up out of the money (i.e., Dupont's stock price is less than 40), then the cash flow from the option is zero no matter what is the risk-free rate. In this case, the combined effect of the risk-free rate going up on the sum of the cash flows from the T-bill and the call options is negative. On the other hand, if the call options end up in the money (i.e., Dupont's stock price is greater than 40), then you would exercise them at a combined strike price of 1,000 (i.e., 25 options * 40 strike price per option). You pay this 1,000 to exercise the options and you receive the 1,000 from the T-bill, so risk-free rates going down have no effect on the sum of the cash flows from the T-bill and the call options. Because the effect of the risk-free rate going down on the sum of the cash flows from the T-bill and the call options is sometimes negative and never positive, the increase in the risk-free rate must decrease the value of the entire TOUCHDOWN.

2) Short discussion questions

A) Uncertain. Whether the $10M investment increased the book value of equity or not depends upon how it was funded. If it was funded with cash (internal capital) or by issuing debt, then the book value of equity will not change when the investment is made. If the project was funded with cash, then cash would fall by $10M and property, plant and equipment would rise by $10M. The total book value of assets and book value of equity would not change. If the investment was funded with debt, then the book value of PPE and the book value of debt would rise by $10M. The book value of equity would not change. If the investment was funded with equity, then the total book value of assets (PPE) and the book value of equity would rise by $10M. Thus book value of equity rises by only if the new investment is financed (at least partially) by equity.

B) It is uncertain whether the announcement raises the market price of Appleton's equity. The project does have more systematic risk and thus a higher discount rate, but because the project is a positive NPV (the expected return is greater than the required return), the project will raise the market value of equity. It may or may not, however, raise the market price of Appleton's equity when the project is announced. This depends on whether or not the announcement was a surprise. If the market knew that the firm had the investment opportunity and was going to take it, then the $6M NPV would already be

[3] You did not need to show this additional step for full credit.

incorporated in the stock price. In this case, the market price of equity would not change upon the announcement. If the market was completely unaware of the investment (even its possibility), then the market price would rise by \$6M upon the announcement. If the investment was partially anticipated (e.g., the market believed Appleton might have good projects), then the market price of equity would rise by the portion of NPV which was unexpected.

3) Investing in risk free bonds

A) If you purchase the ten year government bond, collect the interest, and sell it next year the expected return on this investment is 1.9%. We can derive this from CAPM. The expected return on a one year investment in the ten year bond is:

$$r_{10\,yr\,bond,1\,yr\,holding\,period} = riskfree_{1\,yr} + risk\ premium_{10\,yr}$$
$$= 0.8\% + 1.1\% = 1.9\%$$

The one year risk-free rate (since our holding period is one year) is 0.8%. This is the rate on the one-year T-bill. The risk premium on long government bonds is based on their β. We don't have the β on long bonds, but from the formula page we know that the excess return on long bonds over the risk-free rate (i.e., their risk premium) is 1.1%. Thus the total expected return is 1.9%.

B) The price of the bond is expected to fall by 1.7%. The expected return on a bond is the sum of the expected interest payments and the expected capital gains or losses on the bond. When you buy the ten year par bond, you pay 1,000 for the bond. At end of the year, you will receive the coupon payment of 36 (i.e., 0.036*1,000) and sell the bond at the then current market price. From part A, we know that the total expected return is 1.9%. Thus the coupon payment (expressed as a percent; 3.6%) plus the capital gain (expressed as a percent) must equal 1.9%. Thus the expected capital gain is −1.7%. The bond price is expected to fall by 1.7% to 983.

$$E[return] = \frac{0.036(1000) + E[P_1] - 1000}{1000} = 0.019$$
$$\frac{E[P_1] - 1000}{1000} = 0.019 - 0.036 = -0.017$$

C) The return on long government bonds is *expected* to be greater than 1.9% when the market does better than expected, but it is possible that the return could be less than 1.9%. Because the risk premium on long government bond is positive, so is the β. This means that the return on long government bonds is positively correlated with the market. If the stock market is up more than expected, then the return on the long government bond is expected to be greater than 1.9%, but it will not be greater than 1.9% with certainty. The return would always be greater than 1.9% only if the bond had no idiosyncratic risk. The return on the long bond can still be below 1.9% if the idiosyncratic part of the return (ε) is negative enough.

$$r_{LB} - E\left[r_{Long\,govt\,bond}\right] = r_{riskfree} + \beta_{LB}\left(r_{market} - r_{riskfree}\right) + \varepsilon - \left[r_{riskfree} + \beta_{LB}E\left(r_{market} - r_{riskfree}\right)\right]$$
$$r_{LB} - 1.9\% = \beta_{LB}\left(r_{market} - E\left[r_{market}\right]\right) + \varepsilon$$
$$r_{LB} - 1.9\% > 0 \text{ if } \varepsilon > -\beta_{LB}\left(r_{market} - E\left[r_{market}\right]\right)$$

4) Fishman Catering

A) The market value of Fishman Catering's equity after the dividend is paid is 8,000. After the investment has been made and all free cash flow has been paid out, Fishman Catering provides a perpetuity that pays out 800 per year. The investment this year, will generate an expected (not an actual/guaranteed profit but an expected) profit of 1600 next year. 800 of this cash flow will be reinvested. The remaining money (800 in expectation) will be paid out as a dividend. The same thing happens in year two, year three, etc. Thus the market value of Fishman Catering is:

$$V_{FC\ Equity} = \sum_{t=1}^{\infty} \frac{(1600-800)}{(1+0.10)^t} = \frac{800}{0.10} = 8,000$$

The question did not ask, but if you wanted to calculate the ex-dividend stock price you would divide the ex-dividend equity value (8000) by the number of shares (800). Thus the ex-dividend stock price is 10.

B) The price of Fishman Catering will rise by 300. The market was expecting profits of 1,600, an investment of 800, and thus a dividend of 800 this year. They will also receive the ex-dividend value of the firm. Thus, the cum-dividend value of Fishman Catering (prior to this year's dividend announcement) is 8,800 (i.e., 800 + 8,000 from part A). The dividend announcement will reveal, however, that the dividend is 1,100 (i.e., 1,900 − 800) not the expected 800 (i.e., 1,600 – 800). This raises the dividend today from Fishman Catering by 300. Because the success of the birthday party this year is uncorrelated with the success in future years, the expected cash flows in future years does not change. Thus the price of Fishman Catering will rise by 300 from 8,800 to 9,100.

$$V_{FC\ Equity,\ pre-annc} = 800 + \sum_{t=1}^{\infty} \frac{(1600-800)}{(1+0.10)^t} = \frac{800}{0.10} = 8,800$$

$$V_{FC\ Equity,\ post-annc} = 1,100 + \sum_{t=1}^{\infty} \frac{(1600-800)}{(1+0.10)^t} = \frac{800}{0.10} = 9,100$$

C) The return on the T-shirt project is 5.3%. This is both an expected and an actual return since the project has not risk. This is less than Fishman's cost of capital (10%).

$$r_{Tshirt\ project} = \frac{800}{760} - 1 = 5.3\%$$

D) Reducing the dividends by 760 and taking the T-shirt project raises the wealth of Fishman Catering's shareholders by 33.7. The NPV of the project is 33.7.

$$NPV_{Tshirt\ project} = -760 + \frac{800}{(1+0.008)} = 33.7$$

Because the project is risk free, the correct discount rate is 0.8%. It is true that Fishman Catering's cost of capital (the discount rate is uses to evaluate the birthday party project) is 10%.[4] However, the birthday party project has systematic risk and thus requires a higher discount rate than the T-shirt project which has no risk. You use the firm's cost of capital for new projects only when the β of the new project is the same as the β of the past projects. In this example, that is not the case. The new project has a β of zero, and the past projects have a β of 1.08.

[4] If you incorrectly used a 10% discount rate, you would have found an NPV of −32.7.

You could have shown the increase in value by comparing the value of Fishman Catering equity if they paid a 1,100 dividend and did not take the project to the value of Fishman Catering equity if they paid a 340 dividend (i.e., 1,100 − 760), invested in the project, and paid out the proceeds next year. The value of Fishman Catering under the first dividend/investment policy is 9,100 (see part B). The value of Fishman Catering under the second scenario is 9,133.7, or 33.7 higher.5 Looking at the NPV of an investment thus gives you the number you want – the increase in shareholder wealth.

$$
\begin{aligned}
V_{FC\,Equity,\,post-annc} &= 340 + \frac{800}{(1+0.008)} + \sum_{t=1}^{\infty} \frac{(1600-800)}{(1+0.10)^t} \\
&= 1{,}100 + \left[-760 + \frac{800}{(1+0.008)} \right] + \sum_{t=1}^{\infty} \frac{(1600-800)}{(1+0.10)^t} \\
&= 1{,}100 + 33.7 + 8{,}000 \\
&= 33.7 + 9{,}100 = 9{,}133.7
\end{aligned}
$$

[5] We discount the 800 in year one from the T-shirt project at 0.8% because it is risk-free. The 800 from the birthday party project is not risk-free. It contains systematic risk and requires a discount rate of 10%.