Department of Economics
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Fall 2009

ECONOMICS 136
SAMPLE FINAL EXAM B

THIS EXAM HAS THREE SECTIONS:

I.	**True/False**	**21 Points**
II.	**Problems**	**64 Points**
III.	**Essay**	**15 Points**

INSTRUCTIONS:

You have 3 hours to answer all questions. Number your blue books, and be sure to put your name and your TA's name on all of them. Use one blue book to answer parts I and III; use a second blue book to answer part II.

You are allowed to use three two-sided sheets of formulas and a calculator.

GOOD LUCK!

PART I

Are the following statements true of false? Explain your answer in no more than two sentences. You will be graded on your explanation. (21 points, 3 each)

1. The price of ABC stock is \$45. An American put option with exercise price \$48 is currently trading for \$1.60. There is an arbitrage opportunity.

2. Since investors are compensated for holding risk, two securities with the same standard deviation should have the same expected return.

3. The value effect is not explained by CAPM, because in the data, stocks with high book-to-market ratios have high betas and low average returns.

4. In a CAPM equilibrium, no portfolio has a higher Sharpe-ratio than the market portfolio.

5. According to the logic of mean-variance optimization, highly risk-averse investors should hold no risky assets at all, because the positive expected excess return of stocks will not be enough compensation for the associated risk.

6. In a CAPM economy, a stock whose expected rate of return is less than the riskfree rate is never included in any investor's portfolio because one is always better off choosing the riskfree asset.

7. A strategy that involves selling (writing) a European put and a European call, both with the same exercise price that equals the current stock price, and on the same stock, is a bet that the price of the underlying stock will not change significantly before the expiration of the options.

PART II

1. Capital budgeting (15 points, 3 each)
Consider an economy where CAPM holds, and where the riskfree rate is R_f = 2%, the expected return on the market portfolio is ER_m = 12%, and the standard deviation of the return on the market portfolio is σ_m = 30%. The covariance between the return of ABC stock and the return of the market portfolio is equal to 0.18. All of this data refers to annual returns.

a) What is the expected (annual) return of ABC stock?
b) If ABC's dividends equal \$10 per share next year and grow at a rate of 12% per year subsequently, what is the current price per share of ABC stock?
c) Now suppose that the dividend growth of ABC depends on the success of a clinical trial for their product. If the trial is successful, dividend growth will be 17%. If the trial is unsuccessful, dividend growth will be 7%. The trial is successful with probability 50%. The success of the trial is uncorrelated with the return on the market portfolio (which is to say that the beta of ABC is the same as before). Next year's dividend will be \$10 irrespective of

the outcome of the trial. What should be the share price of ABC stock in this environment? Hint: compute the share price when G=7% with certainty, and when G=17% with certainty. Then compute the expected price knowing the fact that both outcomes are equally likely.
d) Compare your answers to b) and c). Which one is higher? What is the intuition? Explain.
e) Use the analysis in this example to evaluate the argument that technology companies had such high prices in the late 1990s partly because of uncertainty about the success of new technologies used by them. Based on the example, is this argument plausible?

2. Portfolio choice (16 points, 4 each)
Suppose that a stock index behaves as follows over two periods. The initial index value at time t=0 is 100, and each period the index either rises by 15 or falls by 5 with equal probability (so for example at t=2, the highest possible index value is 100+15+15=130). The index does not pay dividends during these two periods. The riskfree rate of return each period is R_f=0%.

a) Draw the event tree for this economy. For each node at t=1, compute the index return between periods 0 and 1. For each node at t=2, compute the index return between periods 0 and 2. What is the mean and variance of the index return over one period (from time 0 to time 1) and over 2 periods (from time 0 to time 2)?
b) Suppose that you are a mean-variance optimizer with risk aversion equal to A = 10. If you wish to invest in a portfolio of the index and the riskfree asset for one period (from time 0 to time 1), what is your optimal portfolio? Now suppose that you wish to form a portfolio at date zero that you have to hold until date 2, so that no rebalancing is allowed at date 1. If A = 10, what is your optimal portfolio?
c) Now assume that the initial probability of a price change remains ½ between periods 0 and 1, but the probability of a price increase in the second period is only ¼ if price rises in the first period, and ¾ if the price falls in the first period. What are the probabilities of the possible outcomes at t=2 under this assumption? What is the mean and variance of the index return over 2 periods (from time 0 to time 2)? Are these results different from the mean and variance of the two-period return obtained in part (a)? What is the optimal portfolio if you want to invest for two periods at date zero (no rebalancing at date 1)? How is your answer different from what you obtained in part (b)?
d) Financial advisors sometimes recommend clients who invest for the long term to hold a larger share of stocks. Use the analysis in this example to comment on this advice.

3. Options (24 points, 4 each)
Consider the same economy as in problem 2: Suppose that a stock index behaves as follows over two periods. The initial index value at time t=0 is 100, and each period the index either rises by 15 or falls by 5 with equal probability (so for example at t=2, the highest possible index value is 100+15+15=130). The index does not pay dividends during these two periods. The riskfree rate of return each period is R_f=0%.

Now consider a European call option on the index, with expiration date T=2, and strike price X=$100.

(a) Draw a new event tree for this economy. For each node in period t = 1 and t = 2, write S_t, the current price of the index. For each node at t = 2, write the payoff of the call option.

(b) Consider the node where the stock price has gone up to $115 in period 1. Construct a portfolio at this node that replicates the payoff of the option in both possible states at t = 2. Specifically, assume that at this node, you purchase *x* shares of the index and *y* shares of the riskfree asset. Solve for *x* and *y* from the assumption that this is a replicating portfolio. What is the price of this portfolio at t = 1 (in the event when the stock price is $S_1 = 115$)? What is the price of the option, C_1, at this event?
(c) Following a similar procedure as in (b), now solve for the price of the option at t = 1 in the event when the stock price is $S_1 = 95$.
(d) Now go back to period t = 0. To compute C_0, construct a portfolio of the index and the riskfree asset that pays C_1 in period t = 1 (that is, the number you obtained in (b) if the price goes up in period 1, and the number you obtained in (c) otherwise). What is the price of this portfolio? What is the price of the call option?
(e) Suppose that a European put option on the index with expiration T = 2 and strike price X = $100 is traded at a price of P_0=$5.425. Is there an arbitrage opportunity in this economy? If yes, construct a portfolio of the put, the call, the index and the riskfree asset to exploit it. If not, why?
(f) Now suppose that, as in problem 2 part (c), the initial probability of a price change remains ½ between periods 0 and 1, but the probability of a price increase in the second period is only ¼ if price rises in the first period, and ¾ if the price falls in the first period. Does this affect your answers to parts (d) and (e)? If yes, in which direction does the call price change? If not, why not?

4. Derivatives (9 points, 3 each)
Consider a European put option and a European call option on XYZ stock. Both of these options expire one year from now, and have the same exercise price X. Suppose that the current price per share of XYZ is $40, and that the annual riskfree return is 5%. Assume that the current price of the put option is the same as the current price of the call option.

(a) Draw the payoff function of the put option and the call option, as a function of S_T, the price of XYZ one year from now. Draw the payoff function of a portfolio that consists of buying one call option and selling (writing) one put option. What is the price of this portfolio today?
(b) Now consider a long forward position on XYZ stock, with delivery date one year from now. Draw the payoff function of this position. What is the forward price today? At what level of S_T does the forward payoff function cross the horizontal axis in the payoff diagram?
(c) Compare the portfolios in (a) and (b). Are their current prices different? How are their payoffs one year from now related? Assuming that there are no arbitrage opportunities, what can you say about the strike price of the put and call options, X?

PART III – ESSAY (15 points)

Write a **short** essay on the topic below. Use formulas and graphs to back up your argument where necessary. Be brief: your essay will be graded on the quality of your arguments and not on length.

The value effect

The value effect is an empirical regularity of stock returns that has attracted a great deal of attention both in academic circles and among practitioners.

a) What are value stocks and growth stocks? What is the value effect?

b) Is the value effect consistent with CAPM? Why or why not?

c) What other risk and return based model has been used to explain the value effect? What is the mechanism by which this model explains the value effect?

d) What other anomalies does this model explain?

e) What is the leading alternative explanation for the value effect that is not based on risk (proposed by Lakonishok, Shleifer and Vishny)? What is the logic of this explanation?