ECONOMICS 136

SAMPLE FINAL EXAM C

THIS EXAM HAS THREE SECTIONS:

I.	**True/False**	**18 points**
II.	**Problems**	**68 points**
III.	**Essay**	**14 points**

INSTRUCTIONS:

You have 3 hours to answer all questions. Number your blue books, and be sure to put your name and your GSI's name on all of them.

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

GOOD LUCK!

PART I

Are the following statements true of false? Explain in no more than two sentences. You will be graded both on your answer and the explanation. (18 points, 3 each)

1) An American call option on ABC with a strike price of $1.30 and expiration date June 2009 is currently trading at $4.40, while the current price of ABC stock is $4.10. There is an arbitrage opportunity.

2) The variance of the return of an equal-weighted portfolio of two assets must be at least as large as the smaller of the variances of the individual asset returns.

3) XYZ has a negative beta with the market portfolio. If CAPM holds, the expected return of XYZ should be negative.

4) For an investor who holds a mortgage pass-through, mortgage prepayment is typically bad news.

5) It is never optimal to exercise an American put option before the date of expiration.

6) ABC pays no dividends and has a price of $15. An American call option on ABC expiring next year with strike $X = \$10$ is currently trading at $5. There is an arbitrage opportunity.

PART II

Note: Please use natural units in solving all problems (e.g., a standard deviation of 20% means $\sigma = 0.2$ and σ^2=0.04).

1. Market timing (28 points, 4 each)

Consider an economy over three periods, $t = 0$, $t = 1$ and $t = 2$. At $t = 0$, the market stock index is trading at a value of 100. At $t = 1$, the index either rises by 30 or falls by 10 with equal probabilities. Following an increase at $t = 1$, the index either increases by 30 with probability 1/4, or falls by 10 with probability 3/4 at $t = 2$. After a fall at $t = 1$, the index either increases by 30 with probability 3/4, or falls by 10 with probability 1/4. Thus the highest possible index value at $t = 2$ is 160, and the lowest is 80. The index pays no dividends, and the riskfree rate in each period is $R_f = 0$.

(a) Draw the event tree of this economy. For both nodes at $t = 1$, compute the net index return between periods 0 and 1. What is the expected return between $t = 0$ and $t = 1$?

(b) What is the expected index return between $t = 1$ and $t = 2$ if the market has gone up at $t = 1$? Is it higher or lower than the expected return between $t = 0$ and $t = 1$?

(c) For each node at $t = 2$, compute the probability of reaching that node and the realized index return between $t = 0$ and $t = 2$. What is the mean and variance of the index return between $t = 0$ and $t = 2$?

(d) Suppose that you wish to form a portfolio of the market index and the riskfree asset at $t = 0$ and hold it until $t = 2$ (no rebalancing at $t = 1$). If you are a mean-variance optimizer with risk aversion $A = 5$, how should you invest? What is the mean and variance of your portfolio return between $t = 0$ and $t = 2$? [Hint: use the mean and variance of the index return from (c) to answer this].

(e) Now consider the following "market-timing" investment strategy. At $t = 0$ invest 100% in the market index. At $t = 1$, if the market has gone up, sell all your holdings and invest everything in the riskfree asset. If the market has gone down at $t = 1$, then continue to hold 100% in the index. If you start with \$100 at $t = 0$, then what is the payoff of this strategy for each node at $t = 2$? What is the net return between $t = 0$ and $t = 2$ for each node?

(f) What is the expected return between $t = 0$ and $t = 2$ of the strategy in (e)? Is it higher or lower than the expected return of the portfolio in (d)? What is the variance of the return from the strategy in (e)? Is it higher or lower than the variance of the portfolio in (d)? Would your mean-variance optimizing investor prefer the strategy in (e) to that in (d)? Does market timing – adjusting the portfolio when expected returns change – benefit the investor?

(g) In historic data, do we observe variation in the expected return of the stock market over time? Based on your answer to (f), how should an investor exploit this?

2. Out-of-the-money puts (28 points, 4 each)

The economy next year is either in a boom or in a recession. The probability of a boom is 3/4, the probability of a recession is 1/4. The current value of the stock market is \$100. In a boom, stock prices go up to \$120, in a recession prices fall to \$80. There is also a riskfree bond, which earns a net riskfree return of $R_f = 0\%$.

(a) What is the expected market return? What is the variance of the market return?

(b) Consider a put option on the stock market with strike price \$81. What are the payoffs of the put in the two states of the world next year? Construct a portfolio of the stock and the bond that replicates the put. Under no arbitrage, what is the put price today?

(c) What is the realized return of investing in the put if the economy is in a boom? In a recession? What is the expected net return of the put? Is it higher or lower than R_f?

(d) What is the covariance of the put return and the return of the stock market? What is the beta of the put with respect to the market return? [To get the beta, use the variance from (a).] What is the intuition for the sign of the beta?

(e) According to CAPM, what should be the expected return of the put? Is this the same as your answer to (c)? Does CAPM appear to hold here?

(f) Suppose you have initial wealth \$100, sell 200 of the above puts, and invest the proceeds (both initial wealth and the gains from selling puts) in the riskfree asset. What is your payoff in a boom? In a recession? What is the probability that you lose money?

(g) A hedge fund manager makes the following claim. "Our fund earns high returns with very high probability. We earned positive returns in each of the past three years. There is essentially no risk, so you should invest your money with us." Do you find this reasoning credible? Do you think there is really no risk involved in earning the high returns? What might be the fund's investment strategy?

3. Shorts (12 points, 3 each)

The price of ABC stock today is $S_0 = \$100$, and the annual riskfree return is $R_f = 10\%$. You expect that the price of ABC is going to fall between now and a year from today ($T = 1$), and would like to profit from this.

(a) By no arbitrage, what should be the forward price today F_0^T of ABC stock for delivery one year from today (at $T = 1$)?

(b) Draw the payoff function, on date T, of a short position in the forward contract you priced in (a). [Do this in the payoff diagram which has the price of the underlying S_T on the horizontal axis and the payoff of your position on the vertical axis.]

(c) Now consider instead, at $t = 0$, the portfolio of shorting one share of ABC and investing the proceeds in the riskfree asset. Draw the payoff of this portfolio on date T in the payoff diagram. Does this portfolio ever have a higher payoff than your investment in (b)? Does it have a higher price at $t = 0$ than your position in (b)?

(d) In practice, you would probably implement (b) with a short futures position. If this is what you do, how might increases in the price of ABC *before* T affect your investment?

PART III – ESSAY (14 points)

Write a short essay on the topic below. Be brief: your essay will be graded on the quality of your arguments and not length.

Valuation ratios and expected returns

(a) What is a valuation ratio? Describe three commonly used valuation ratios.

(b) How has the price-earnings ratio of the US market (S&P500) behaved over time? As we discussed in class, if the market P/E is to return to its historic average, it should predict subsequent changes in at least one of two variables. Why are these variables, and how should they be related to P/E? Explain using figures.

(c) Which of these variables does the P/E of the US market predict in historic data? Were the events of this fall consistent with this prediction? Do current valuation ratios have a sharp prediction about the long term stock market outlook for the next ten years?

(d) Now consider individual stocks. In the data, do differences in valuation ratios predict differences in expected returns across stocks? How? What is the name of this effect?