

The homework is due on Wednesday, November 11. Question 1 is worth 1.6 points. The remaining questions are worth 0.8 points each.

Question 1 (For the following see also the information in Lecture 13). Get the weekly adjusted closing prices from January 2000 to present for the following stocks from <http://finance.yahoo.com>:¹

BAC (Bank of America), ADM (Archer Daniels Midland Company, Agricultural Products, Decatur Illinois), AAPL (Apple Computers), DNDN (Dendreon Corporation, a biotech stock).

Do the same for the S&P500, which we use as the market portfolio. Then reorder the data so that the dates are ordered from oldest to latest.

Get the 6 month treasury bill rate from the website of the Federal Reserve. Go to <http://www.federalreserve.gov/datadownload/>. Then

- (a) Determine α and β . Does α differ from zero for some of the stocks statistically, i.e., did some stocks have excess returns $\alpha > 0$, or below market returns $\alpha < 0$ with a probability of 90 or 95%?
- (b) Check whether α and β changed if you consider only the data starting in January 2007.

For all these questions you need to provide the Excel printout of the regression results. Click on the link “selected interest rates H.15.” Then click on “go to select” under build your package. On the next page under item 1 choose “Selected Interest Rates.” Under item 2, TCMNOM (U.S. government securities/Treasury constant maturities/Nominal. Item 3 select 6 months; item 4 weekly. Then select “go to format” and select the appropriate date and choose either Excel or csv (which also can be read by Excel).

Then combine the data in one spreadsheet. Note that the interest data is from Friday - Friday, while the Stock data is Monday-Monday. Just ignore this difference of one trading day.

Question 2 The key to any good investment strategy is diversification, i.e., to invest in a variety of stocks rather than just a few. This question demonstrates that danger of holding a risky portfolio over time.

¹In order to get the prices, go to <http://finance.yahoo.com> and click on *symbol lookup*. This allows you to find the symbol under which the stock is traded. Then type in the symbol into the *Enter Symbol* box. Next, look on the left side of the page for *Historical prices*. Click on this link. On the next page, you could choose the range, but the default is the maximum range from the company’s start to present. Then choose weekly. Go to the bottom of the page and click on download to spreadsheet.

- (a) Suppose that a person has all of his/her investments in a stock with a real return of 10% per year. In particular, the stock's return at the end of the year is either 1.7 or 0.5 with probability 0.5 each. You are supposed to find the median return after 30 years.² To do this analytically would be somewhat difficult. However, it can be done much more easily by using a so called "Monte Carlo simulation."

Consider the posted spreadsheet and open the first worksheet. In the second row you find a sequence of random realizations. Note, that each of this realizations uses the Excel function Rand(). Rand() produces a random number between 0 and 1 (uniform distribution). So the statement

$$\text{IF}(\text{RAND()}>0.5,1.7,0.5)$$

assigns the realization 1.7 whenever Rand() is greater than 0.5 and, the realization 0.5, otherwise. Thus, we implement random return of the stock that yields 1.7 and 1.5 with probabilities 0.5 each. Now copy this row and paste it into the 3,999 remaining rows. Now you 4,000 possible random realizations of the stock over the 30 years. Now compute the median of year 30 (i.e., column AF) of the 4,000 different realizations. This gives you an approximation of the median return after 30 years by using a Monte Carlo simulation.

- (b) Now suppose that there are two stocks that are not correlated, i.e., each stock has a return of 1.7 or 0.5 with probability 0.5 each. If you invest half of your money in each stock your return in Excel notation is

$$0.5*\text{IF}(\text{RAND()}>0.5,1.7,0.5)+0.5*\text{IF}(\text{RAND()}>0.5,1.7,0.5).$$

Use the second worksheet to determine the median return at the end of 30 years if you diversify by investing in both stocks by using a Monte Carlo simulations.

Question 3 Assume you consider purchasing a used car. If the car is of good quality then your benefit of getting the car is \$4,000. If the car is of low quality, your benefit is \$2,000. You believe that the seller is willing to sell the car to you if you pay at least \$3,000 if the car is good, and \$1,500 if the car is bad.

- (a) Assume that you believe that the sellers car is good with probability 0.8. Then in order to maximize your expected net-benefit, you should offer how much money for the car? Determine you expected net-benefit?
- (b) How do your answers to (a) change if you believe that the seller's car is good with probability 0.4.

Question 4 Assume there are three types of drivers. Excellent drivers have an accident probability of 1/1000. Good drivers have an accident probability of 10/1000 and

²Recall that if \bar{m} is the median return, then this means that there is 50 percent probability that the return is less than \bar{m} and a 50 percent probability that the return is greater than \bar{m} .

bad drivers have an accident probability of $49/1000$. There is the same number of drivers of each type in the population. Therefore, the overall accident probability is $(1/3)(1/1000) + (1/3)(1/100) + (1/3)(49/1000) = 1/50$. The expected loss from an accident is \$10,000. Insurance company *A* offers full coverage at a premium of \$250 (i.e., \$250 is the price of the insurance). Each person would get insurance under the same conditions, because the insurance company cannot tell the type of a driver.

By law every driver must sign up for insurance. Therefore, if *A* is the only insurance company then they expect to pay $(1/50)10,000 = 200$ per customer. The expected profit per customer is then $250 - 200 = 50$ (because the insurance premium is \$250).

Insurance company *B* enters the market and decides to offer insurance only to drivers who have a clean driving record. It turns out that all excellent and good drivers have a clean record. Bad drivers do not have a clean record.

- (a) Suppose that insurance company *B* wishes to make an expected profit of \$50 per driver, then it should charge how much for an insurance contract that offers complete coverage?
- (b) Assume insurance company *A* does not adjust the premium and the contract after *B* has entered the market. Determine *A*'s expected profit per customer.
- (c) Suppose that insurance company *A* is unwilling to offer insurance only to drivers with a clean record, and wishes to have an expected profit of \$50 per customer. How much should company *A* charge?