

Name: _____

Problem set 1
266: Fi. Markets and Institutions
Spring 2015
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Directions. You are to do this problem set alone. If you would benefit from conferring on how to do the part that is in Excel, this is ok, but complete the work yourself.

Due Date/time. Your work is due by the beginning of class February 17. You can hand the work in to me at the beginning of class or bring it to my office before I leave for class at about 10:20am. Only hardcopy submissions allowed.

Note: Be sure to pay attention to whether you are stating rates in percent terms or proportional terms. You need not show your work, BUT even if you get the wrong answer, you may get partial credit if you do show your work.

Questions. If you have questions, email me or the TAs or raise them in class, or come to office hours.

Grading. All parts have equal value (5 points each).

1 Percent changes

- 1.1 I invest \$500 today and get back \$550 in 3 years. In percentage terms, how much has my value increased?

- 1.2 At what annualized rate did my value in the previous problem increase?

- 1.3 Someone offers me \$5 to come 18 months from now. If the relevant interest rate is 7.3 percent, what is the present value of this gift?

- 1.4 An investment will pay \$7 in 1 year and \$8 in two years. The current price of this investment is \$14.30. What is the internal rate of return?

- 1.5 I bought a house at the beginning of 2007 for \$200,000 and sold it at the end of 2007 for \$150,000. What was my capital loss? What was my rate of capital loss over the year?

2 Probability and Statistics. Table 1 presents the prices of 4 assets (A, B, C, and D) in year $t + 1$ under 3 different outcomes. The probabilities of each outcome are included. Note that none of the four assets makes any coupon or dividend payments, all prices are in \$, and t is measured in years.

Table 1

outcome	prob.	price at t+1			
		A	B	C	D
1	.3	5	18	16	18
2	.5	5	22	14	12
3	.2	5	26	12	23

2.1 Suppose that the price of asset A today (in period t) is \$4.854 . What is the expected return (in annual percentage terms) from buying A today and selling it in period $t + 1$?

2.2 Given your answer to the above question, what should be the price of a portfolio consisting of one unit of asset B and two units of asset C? What, then, is the expected return to holding this portfolio? (Hint: think law of one price.)

2.3 What is the sign of the covariance of the prices of assets B and C? What is the sign of the correlation?

2.4 What is the variance of the price of asset D?

3 Analyzing a 10-year bond. Note: This problem uses the spreadsheet ps12015.xlsx provided with the problem set. Go to the tab in the spreadsheet labelled 'bond'. This spreadsheet allows you to enter a par value, coupon value, and constant interest rate i , and will use our standard formula to compute the present value and duration of the bond under the stated conditions.

Complete the spreadsheet following the instructions in blue. When you are done, as a check see that i) if you enter a bond with implied coupon rate equal to the specified interest rate, i , then the present value equals the par value, and ii) if you put in a coupon of zero, the duration should equal 10, the time until to the only payment.

3.1 Take a bond with par value 200, coupon 5, and constant interest rate 2% [this mistakenly said 1% in earlier version of prob set]. State the present value and duration.

3.2 According to the spreadsheet, what will be the present value of the bond at an interest rate of 2.5 percent?

3.3 Given the change in the present value in the previous two parts, what is the implied rate of capital gain or loss?

3.4 If the interest rate rises from 2% to 2.5%, what approximate rate of capital gain does our duration-based formula suggest will occur? How does this approximate value compare to the value computed in the previous part?

3.5 As the interest rate falls, what happens to the duration of this bond? Provide some intuition for this result.

4 Some real world data. This problem uses the spreadsheet ps12015.xlsx provided with the problem set. Go to the tab in the spreadsheet labelled ‘real returns’. This sheet gives annual real returns for the years 1954–2014 for 4 asset or portfolios:

t1y... 1-year U.S. Treasury securities.

mkt... a broad portfolio of stocks

comps... a portfolio of computer stocks

banks... a portfolio of banking stocks

The Treasury data are from Fred (<http://www.research.stlouisfed.org/fred2/>) as are the CPI data used to compute inflation in order to convert these to real returns. The stock return data are from Ken French’s data library (http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html). The returns are transformed to approximate real returns by subtracting the CPI inflation rate.

4.1 Describe what sorts of firms are included in the ‘comps’ and ‘banks’ portfolios. (Hint: Go to the Ken French data library link above, scroll down to the 48 industry portfolios links and click on ‘details’, you should be able to get the answer from there.)

4.2 Complete the spreadsheet by following the notes highlighted in blue. What are the mean and standard deviation of the returns on t1y, mkt, comps, and banks?

mean:

std. dev.:

Note about calculating standard deviation: For reasons that are not central to our problem, when taking the standard deviation of a sample of data, one often divides the sum of squared deviations by $N - 1$ (one less than the number of terms in the sum) rather than N . In the spreadsheet, we have used the function `stdev`, which follows this convention. See the excel help for `stdev` vs. `stdevp` for a bit more on this, or consult any elementary statistics text. When N is largish, this obviously does not matter much.

- 4.3 Using the mean return, compute approximately how much money you would have at the end of 2014 if you had put \$1 in the t1y asset (short-term Treasury security) at the beginning of 1954 and reinvested all proceeds each year?

- 4.4 Using the mean return, compute approximately how much money you would have at the end of 2014 if you had put \$1 in the mkt portfolio at at the beginning of 1954 and reinvested all proceeds each year?

- 4.5 What is the lowest rate of return you would have made in any year if you were invested in t1y? And the lowest returns for mkt and for banks?

4.6 You consider putting all your funds in a portfolio split between comps and banks. What would be the mean and standard deviation of the portfolio if you put the following percent of funds into comps: 10%, 25%, 50%, 75%, 90%?

mean:

stdDev: