Problem Set 8

Ec 136, Fall 2009

This problem set is due Thursday, December 3. Sorry, no late problem sets are accepted! All students must submit problem sets individually. Write your name, section time and GSI on the front page of your solution.

1. CAPM test

This question asks you to test CAPM by looking at the historical performance of small stocks and value stocks using Excel. The data are in CAPM_data.xls on the course website. We will focus on five risky assets: four stock portfolios called small-low, small-high, big-low, big-high, and a value-weighted stock index that we will treat as the market portfolio. Here "small" and "big" refer to market capitalization, while "low" refers to growth stocks (low book-market ratios), and "high" refers to value stocks (high book-market ratios). Thus for example the small-low portfolio is a portfolio of growth stocks with small market capitalization. The data set runs from January 1930 to December 2004 and contains excess returns $R_i - R_f$ (where R_f is the return on 90-day Treasury bills) for all five risky portfolios. In parts a)-f) of this problem we will focus on the period **1/1930-12/1963** only.

a) Download the data from the course website. What are the average excess returns for the five risky portfolios during 1/1930-12/1963? Use Excel to compute your answers in row 6, columns I-M.

b) What are the betas of the five portfolios during 1/1930-12/1963? To answer, in I7 write =SLOPE(B$6:B$413,$F$6:$F$413). This expression will compute the slope coefficient β_i of a linear regression

$$R_i - R_f = \alpha_i + \beta_i (R_m - R_f) + \varepsilon_i$$

in which the left hand side variable is contained in B$6:B$413 in the spreadsheet (excess return on small-low portfolio), while the right hand side variable is contained in $F$6:$F$413 (excess return on market). Thus, by definition, Excel computes the beta of the small-low portfolio in I7. Repeat the same procedure for columns J-M in row 7 to compute the betas of all other portfolios for 1/1930-12/1963.

c) What are the alphas of the five portfolios? To answer, in row 8 let's compute the intercepts in the linear regression discussed in part b). Use the INTERCEPT command in Excel to do this. (The intercept is, by definition, the alpha.)

d) What expected excess returns are predicted by CAPM? According to the CAPM equation we should have $\mathrm{E}R_i - R_f = \beta_i (\mathrm{E}R_m - R_f)$. Following this equation, in row 9, compute the product of β_i, and $\mathrm{E}R_m - R_f$ for all five portfolios.

e) Compare rows 6 and 9. Do you see a big difference between the CAPM predicted mean excess returns and the actual mean excess returns? You can also do this comparison by

looking at the magnitude of the alphas (which are the difference between the predicted and true mean excess returns).

f) Plot the security market line predicted by CAPM, as well as the actual position of the five portfolios in (beta, expected return) space. Do this by selecting I7:M7, holding Ctrl, selecting I9:M9, clicking the Chart Wizard and selecting XY Scatter. Then click Next, choose Series in the top, rename series 1 as "CAPM prediction," click Add, and for the new series, select the betas as X values and the actual mean excess returns as Y values (you can also rename the series). Create the chart in a new worksheet. [In Office 2007, after selecting the data as above, click Insert, choose a scatter plot with only markers, and move the diagram to a new worksheet. Then right click the plot area, choose Select Data, Add, and set the betas as X values and the actual mean excess returns as Y values. Add a name to the series. You can also rename series 1 in this box by selecting it and clicking edit.] To add the predicted SML, right-click any point from the first series and add a linear trendline. Does CAPM work in this data? Please turn in a printout of your figure with the solution.

g) Now test the CAPM by following the procedure outlined above for the time period 1/1964-12/2004. Turn in a priontout of your figure for this question too. Compare your results with the earlier time period. Does CAPM work over the more recent period? Which portfolio has the highest alpha?

2. Derivatives

a) The spot price of ABC today is \$12, and the annual riskfree rate of return is $R_f = 3\%$. It is known that ABC does not pay dividends during the next year. What is the forward price of ABC for delivery 1 year from today? For delivery six months from today? For delivery today?

b) The stocks of ABC and XYZ are traded at the same price of \$19 a share. The historical returns of ABC are more volatile than those of XYZ and exhibit higher systematic risk. Neither ABC nor XYZ will pay dividends in a month. Consider forward contracts on these two stocks with three months to maturity. Should the forward price for ABC be lower than the forward price for XYZ? Why or why not?

3. Using derivatives

How would you use derivative securities to achieve each of the following objectives? Explain.

a) You have stocks in a trust account that you cannot sell for a year; afterwards you will have full control. You are concerned that the market will fall during the next year. You want to protect yourself against downside risk at minimal expense, and you don't mind giving up the chance of profit if the market rises.

b) The same situation as in part a), but you want to retain the chance of profit if the market rises, and you don't mind spending some money to do it.