

# Assignment 3, Econ214a

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Download the Excel file 'returns.xls' from my homepage.

The data set consists of 228 monthly returns on 20 stocks, the riskfree T-bill and the FTA-All Share Index (similar to S&P500) over the period 1975:1 - 1993:12. Use either Huang and Litzenberger or the Appendix in Roll (1977) to do the following exercises:

- (i) In mean-standard deviation space plot the efficient frontier for
  - (a) the first 10 risky stocks
  - (b) the total set of 20 risky stocks.

Comment on the difference between (a) and (b).

- (ii) Compute the mean and standard deviation of returns on the MVP (minimum variance portfolio). What are the portfolio weights of the MVP?

Now suppose that the riskfree instrument pays a return equal to the mean return on the T-bills.

- (iii) Using this value for the riskfree rate, derive the mean and standard deviation of returns on the optimal (tangent-) portfolio on the efficient frontier. Also report the weights of this portfolio ( $X_m$ ). Plot the capital allocation line connecting the riskfree rate with the optimal risky portfolio.

- (iv) Report the mean return of the portfolio orthogonal to the tangential efficient portfolio found under (iii) ( $X_m$ ). Show that this portfolio's returns are indeed orthogonal to those of the tangential portfolio.

Next, split the data set into two halves, each consisting of 114 observations. Use the first sub-sample to estimate the betas for each individual stock from time-series regressions

$$r_{it} - r_{ft} = \alpha + \beta(r_{mt} - r_{ft}) + \varepsilon_{it}, i = 1, \dots, 20,$$

where  $r_{mt}$  is the return on the FTA-All Shares Index and  $r_{ft}$  is the proxy for the monthly risk-free interest rate. For each stock,  $i$ , this gives you an estimate  $\hat{\beta}_i$ .

- (v) Plot the cross-section of beta-estimates and describe their distribution. Are they evenly spread around 1?

Keep the above beta estimates fixed in the following exercise: for each period  $t = 115, \dots, 228$ , estimate a cross-sectional regression

$$r_{it} = \lambda + \gamma_t \hat{\beta}_i + \varepsilon_t, i = 1, \dots, 20$$

Save the regression coefficients  $(\hat{\gamma}_{115}, \dots, \hat{\gamma}_{228})$ .

(vi) Treating the  $\hat{\gamma}_t$ -estimates as a time series, determine whether beta risk is priced in this sample. Try to point towards factors that may explain your finding.

(vii) Suppose that, in place of the FTA-All Share index, you use instead the mean-variance efficient portfolio,  $X_m$ , from (iii) as your market index in the full-sample regression of mean excess returns on beta-estimates computed with respect to this portfolio. How good will this fit be?

(viii) Plot the time-series returns on the portfolio  $X_m$  against the returns on the FTA-All Shares portfolio. What is their correlation? Is the FTA-All Shares portfolio mean-variance efficient?