

## COMPUTER ASSIGNEMENT 4

Consider the assumptions of a single factor model (SFM), where for the common factor we have  $\bar{R}_m = 15\%$ ,  $\sigma_m = 20\%$ . Furthermore, there is exists NO riskless asset, and we know the following information about 6 risky assets.

	$\bar{R}_i$	$\beta_i$	$\sigma_{ei}^2$
1	25,1%	2	0,002
2	19,8%	1,5	0,003
3	17,0%	1,2	0,004
4	14,8%	1	0,005
5	12,8%	0,8	0,006
6	12,0%	0,7	0,007

1. Using the SFM parameters, find out the mean-variance theory (MVT) inputs – vector of expected returns and the variance-covariance matrix.
2. Consider shortselling is allowed without bounds.
  - (a) Represent in the mean-variance space  $(\sigma, \bar{R})$  the efficient frontier.
  - (b) What can you conclude about the efficient of the 6 original risky assets?
3. Assume stock returns are approximately Gaussian.
  - (a) Estimate the probability that the minimum variance portfolio has negative returns.
  - (b) Determine the combination of the 6 risky assets, that has the lowest possible probability of negative returns.
  - (c) Identify all efficient portfolios that have at most 25% probability of negative returns. Represent it graphically.
4. Consider the factor used for the SFM model is a good proxy to the *market portfolio*, and that we believe in a two-factor CAPM. Assume, furthermore, that we consider asset 1 is in *equilibrium*.
  - (a) Verify which of the other basic risky assets are in equilibrium, underpriced or overpriced.
  - (b) Suppose Mr. Capm would like to invest in a portfolio:
    - \* That uses only risky assets that are in equilibrium or underpriced.
    - \* That is efficient.
    - \* That has a  $\beta_p \leq 1.5$ .
    - \* That verifies  $\Pr [R_{Mr.Capm} \leq 0\%] \leq 25\%$ .

What is your recommendation? Represent it in mean-varinace space  $(\sigma, \bar{R})$ .

5. Suppose now that short-selling is forbidden.
  - (a) Find the maximum and minimum risk combination of the 6 basic risky assets. Explain.
  - (b) Determine the efficient frontier in this setup and graphically compare it with the unrestricted envelop hyperbola in Question 2.
6. Suppose shortselling of risky assets is allowed again, but consider now that there exists also a riskless asset with  $R_f = 5\%$  that can be used for deposits (but not for borrowing).
  - (a) Find out the new efficient frontier. Compare it with that of Q.2.
  - (b) Check if the so-called tangent portfolio,  $T$ , verifies the Telser restriction in Q.3(c).
  - (c) What would you recommend to Mr. Capm if you could to use all 6 risky assets and the riskless deposit (i.e., if you could ignore his first restriction in Q.4)?