

COMPUTER ASSIGNEMENT 1

Consider two risky assets, stocks  $S$  and bonds  $B$ , for which we know:

$$\bar{R}_S = 10.3\%,$$

$$\bar{R}_B = 6.2\%,$$

$$\sigma_S = 12.2\%,$$

$$\sigma_B = 5.5\%.$$

1. Represent in the mean-variance space  $(\sigma, \bar{R})$ :

- (i) the two basic assets,
- (ii) the investment opportunity set (IOS),
- (iii) the efficient frontier (EF),

for various correlations across the two assets returns. Use  $\rho_{SC} \in \{-1, -0.5, -0.25, 0, 0.5, 0.75, 1\}$ . Highlight the non-shortselling areas of IOS and EF. Interpret your results.

2. Assume now a fixed correlation value:  $\rho_{SC} = 0.34$ .

(a) Consider combinations of  $S$  and  $B$  and that shortselling is allowed.

- (i) Write down the mean-variance inputs.
- (ii) Find the combination of  $S$  and  $B$  with the lowest possible risk. Determine its expected return and volatility.
- (iii) Can an investment of 100% in any of the basic assets be considered efficient? Why or why not?
- (iv) How could an expected return level of 12% be attained? Is that efficient?
- (v) How could a volatility of 10% be attained? What is the efficient combination?
- (vi) What would you recommend an investor, Mr. Low, that wishes to efficiently invest 10 000 euros and bear the exact same risk as the risk of asset  $B$ ? Explain.
- (vii) How would your answers to (i)-(v) change if shortselling is not allowed.

(b) Suppose now there is in addition a riskless asset that can be used to both lending and borrowing with an  $R_f = 5\%$ .

- (i) Find the efficient frontier.
- (ii) What would you now recommend to an investor that wishes a risk level equal to the risk level of asset  $B$ .
- (iii) Consider another investor, Mr. High, whose optimal risk level is 15%. How should he invest? Which return should he expect?

(c) Represent all answers to questions in (a)-(b) in the the mean-variance space  $(\sigma, \bar{R})$ .