EXERCISES

EXERCISE 1

Suppose that the conditions of CAPM are fully respected. The market portfolio expected return is 5% and the risk-free rate is 1%. We create a portfolio in which 30% of the wealth is placed on security A, whose beta is equal to that of the market, 50% on security B, whose beta is twice that of the market, and the remaining 20% is invested in the risk-free asset. What is the expected return of the portfolio?

The beta of the market portfolio is equal to 1. Therefore, the beta of A is also 1, and the beta of B is equal to 2. As CAPM holds, the expected return of A is equal to that of the market portfolio (because it has the same beta), while that of B is:

$$E[R_B] = R_f + \beta_B * \left(E[R_M] - R_f\right) = 0.01 + 2 * (0.05 - 0.01) = 0.01 + 0.08 = 0.09$$

Hence, the expected return of the portfolio is:

$$E[R_P] = 0.3 * 0.05 + 0.5 * 0.09 + 0.2 * 0.01 = 0.062 = 6.2\%$$

EXERCISE 2

The market portfolio has an expected return of 5%, and the risk-free rate is 1%. Suppose that the conditions for CAPM are fully respected. The expected return of a portfolio in which 40% of the wealth is placed in stock A and 60% in an ETF that perfectly replicates the market portfolio is 7%. What is the beta of stock A?

First, we determine the beta of the portfolio:

$$E[R_P] = R_f + \beta_P * \left(E[R_M] - R_f\right)$$

$$0.07 = 0.01 + \beta_P * (0.05 - 0.01)$$

$$0.06 = 0.04\beta_P$$

$$\beta_P = \frac{0.06}{0.04} = 1.5$$

The beta of a portfolio is equal to the weighted average of the beta of its components. The beta of the ETF is equal to 1 (because it replicates the market portfolio). Therefore, the beta of Stock A is:

$$1.5 = 0.4 * \beta_A + 0.6 * 1$$

$$0.9 = 0.4 * \beta_A$$

$$\beta_A = \frac{0.9}{0.4} = 2.25$$

EXERCISE 3

In a perfect capital market, a company has outstanding shares worth 100 million euro, and has 40 million euro of debt. The annual cost of equity is 8%, while the annual cost of debt is 5%. What would be the cost of equity if the company had no debt?

In a perfect capital market we know from the Modigliani-Miller proposition II that

$$R_E = R_U + \frac{D}{E}(R_U - R_D)$$

where R_U is the unlevered cost of equity, i.e., the cost of equity if the company has no debt. Therefore, we have:

$$0.08 = R_U + \frac{40000000}{100000000}(R_U - 0.05)$$

$$0.08 = R_U + 0.4R_U - 0.02$$

$$1.4R_U = 0.1$$

$$R_U = \frac{0.1}{1.4} \approx 0.071$$

EXERCISE 4

Consider the following series of <u>unadjusted</u> monthly closing prices (in euro) of a stock that undergoes the corporate events indicated next to the price.

January: 7

February: 6.5   Dividend of 1 euro per share is paid

March: 7.5

April: 7.2

May: 4   2 for 1 stock split

June: 4.5

Compute the adjusted stock returns.

First, we adjust the prices to account for the stock split:

January: $7/2 = 3.5$

February: $6.5/2 = 3.25$ Dividend: $1/2 = 0.5$

March: $7.5/2 = 3.75$

April: $7.2/2 = 3.6$

May: 4

June: 4.5

Now we compute the returns, accounting for the dividend in February:

$$R_{Feb} = \frac{3.25 + 0.5 - 3.5}{3.5} \approx 0.071$$

$$R_{Mar} = \frac{3.75 - 3.25}{3.25} \approx 0.154$$

$$R_{Apr} = \frac{3.6 - 3.75}{3.75} = -0.04$$

$$R_{May} = \frac{4 - 3.6}{3.6} \approx 0.111$$

$$R_{Jun} = \frac{4.5 - 4}{4} = 0.125$$

EXERCISE 5

In order to implement a straddle strategy you buy for 2 euro a call stock option and for 2 euro a put stock option, both with a 20 euro strike price. At the expiration date the price of the stock on the market is 25 euro. What is the net profit that you earn from the entire operation?

As the strike price is lower than the market price, we exercise the call and not the put.

The net cash flow for the call and the put is respectively:

$$C_{call} = \max(25 - 20\,, 0) - 2 = 5 - 2 = 3$$

$$C_{put} = \max(20 - 25\,, 0) - 2 = 0 - 2 = -2$$

The net profit of the entire operation is $3 - 2 = 1$ euro.