EXERCISES

EXERCISE 1

A corporation paid a dividend of 10 euro per share in 2023 and a dividend of 10.1 euro in 2024. We expect the dividend to keep growing at the same rate forever. The annual cost of equity is 5% and the annual cost of debt is 2%. What should the price of the shares be according to the dividend-discount model?

The annual growth rate of the dividend from 2023 to 2024 was $10.1/10 - 1 = 0.01$. We know that it will stay like this forever, so the growth rate will always be 1%. We have therefore a growing perpetuity.

The cost of debt is irrelevant in the dividend-discount model. The cost of equity is 5%. Therefore the price of the share should be:

$$P_0 = \frac{Div_{2025}}{R_E - g} = \frac{Div_{2024} + gDiv_{2024}}{R_E - g} = \frac{10.1 + 0.01 * 10.1}{0.05 - 0.01} = \frac{10.201}{0.04} = 255.025$$

EXERCISE 2

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: 18

February: 18.6

March: 5.6 3 for 1 split

April: 6.4

May: 3.4 2 for 1 stock split

June: 3.7

Compute the adjusted stock returns.

The prices before the first stock split must be adjusted for both splits. We can do this by dividing those prices by a cumulative adjustment factor given by the product of the two splits' ratios. The prices in March and April only need to be corrected for the May split, so we can just divide them by 2.

January: $18/(3 * 2) = 3$

February: $18.6/(3 * 2) = 3.1$

March: $5.6/2 = 2.8$

April: $6.4/2 = 3.2$

May: 3.4

June: 3.7

Now we compute the returns:

$$R_{Feb} = \frac{3.1 - 3}{3} \approx 0.033$$

$$R_{Mar} = \frac{2.8 - 3.1}{3.1} \approx -0.097$$

$$R_{Apr} = \frac{3.2 - 2.8}{2.8} \approx 0.143$$

$$R_{May} = \frac{3.4 - 3.2}{3.2} = 0.0625$$

$$R_{Jun} = \frac{3.7 - 3.4}{3.4} \approx 0.0.88$$

EXERCISE 3

Given the following series of returns

0.048 , 0.02 , -0.01 , 0.1

and the following series of risk-free rates

0.005 , 0.005 , 0 , 0

Compute the Sharpe ratio of the investment.

The Sharpe ratio is given by:

$$SR = \frac{E\left[R_p - R_f\right]}{SD(R_p - R_f)}$$

First we compute the excess return:

$$0.048 - 0.005 = 0.043$$

$$0.02 - 0.005 = 0.015$$

$$-0.01 - 0 = -0.01$$

$$0.1 - 0 = 0.1$$

Then we compute the mean and the standard deviation of the excess returns:

$$\overline{R_{exc}} = \frac{0.043 + 0.015 - 0.01 + 0.1}{4} = 0.037$$

$$\sigma^2 = \frac{1}{T-1}\sum_{t=1}^{4}\left(R_{exc,t} - \overline{R_{exc}}\right)^2$$

$$= \frac{(0.043 - 0.037)^2 + (0.015 - 0.037)^2 + (-0.01 - 0.037)^2 + (0.1 - 0.037)^2}{3}$$

$$\approx \frac{0.000036 + 0.000484 + 0.002209 + 0.003969}{3} \approx 0.0022$$

$$\sigma = \sqrt{0.0022} \approx 0.0469$$

So the Sharpe ratio is:

$$SR = \frac{0.037}{0.0469} \approx 0.789$$

EXERCISE 4

A risky investment is estimated to deliver the following returns.

After 9 months:

- $R = -0.15$ *with a 20% probability*
- $R = 0.1$ *with a 70% probability*
- $R = 0.25$ *with a 10% probability*

After 24 months:

- $R = -0.2$ *with a 20% probability*
- $R = 0.15$ *with a 60% probability*
- $R = 0.3$ *with a 20% probability*

The annual inflation rate is 3%.

What is the real cumulative expected return after 24 months?

First we need to compute the expected return at 9 months and at 24 months.

$$E[R_{9m}] = \sum\nolimits_R p_R R = 0.2 * (-0.15) + 0.7 * 0.1 + 0.1 * 0.25 = 0.065$$

$$E[R_{24m}] = \sum\nolimits_R p_R R = 0.2 * (-0.2) + 0.6 * 0.15 + 0.2 * 0.3 = 0.11$$

The cumulative expected return at 24 months is:

$$R_{24m,cum} = \prod_{t=1}^{2}(1 + R_t) - 1 = (1 + 0.065)(1 + 0.11) - 1 \approx 0.182$$

The 24-month inflation rate is:

$$i_{24} = (1 + i_{12})^2 - 1 = (1 + 0.03)^2 - 1 = 0.0609$$

So the real cumulative expected return after 24 months is:

$$R_r = \frac{1 + R}{1 + i} - 1 = \frac{1 + 0.182}{1 + 0.0609} - 1 \approx 0.114$$