Methods of assessing the profitability of investments on the capital market

DR KRZYSZTOF KOWALKE

Profit and risk

Profit and risk are the most important characteristics of investments. When the risk is higher, the expected rate of return on investment should also be higher.

Rate of return

$$r_t = \frac{P_t - P_{t-1} + D_t}{P_{t-1}}$$

r_t – the rate of return in period t

P_t – price of the financial instrument in period t

P_{t-1} – the price of the financial instrument in the period (t – 1)

D_t – paid dividend in the period between (t – 1) and t

Expected rate of return

This measure informs us what the projected rate of return on investment is in the next period. It is usually calculated in two ways:

- based on expert analysis
- based on historical data

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When we use expert analysis

$$E(r) = \sum_{i=1}^{m} p_i \times r_i$$

E(r) – expected rate of return on the financial instrument

r_i – realizable rate of return i

p_i – the probability of realizing the rate of return *i*

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The expected rate of return based on historical data

- arithmetic mean
- geometric mean

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Arithmetic mean

$$E(r_a) = \frac{r_1 + r_2 + r_3 + \ldots + r_n}{n}$$

$E(r_a)$ – expected rate of return based on arithmetic mean

n – number of periods

r_n – rate of return in the n-th period (historical data)

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Example

Price changes in the first investment period:

100 PLN → 150 PLN → rate of return +50%

Price changes in the second investment period:

150 PLN → **75 PLN** → rate of return (-50%)

Arithmetic mean:

$$E(r_a) = \frac{0{,}5 + (-0{,}5)}{2} = 0 = 0\%$$

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Formula for the geometric mean using rate of return

$$E(r_g) = [(1 + r_1) \times (1 + r_2) \times \cdots \times (1 + r_n)]^{\frac{1}{n}} - 1$$

$E(r_g)$ – expected rate of return based on geometric mean

n – number of periods

r_n – rate of return in the n-th period (historical data)

r_1, r_2, … - historical rate of return

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Formula for the geometric mean using share prices

$$E(r_g) = \left(\frac{P_n}{P_0}\right)^{\frac{1}{n}} - 1$$

$E(r_g)$ – expected rate of return based on geometric mean

P_n – the value of the shares at the end of the analysis period

P_0 – the value of the shares at the beginning of the analysis period

n – number of periods

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Example

Price changes in the first investment period:

100 PLN → 150 PLN → rate of return +50%

Price changes in the second investment period:

150 PLN → **75 PLN** → rate of return (-50%)

Geometric mean:

$$E(r_g) = \left(\frac{75}{100}\right)^{\frac{1}{2}} - 1 = (-0.1340) = (-13.40\%)$$

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Variance and standard deviation

These measures indicate how the actual rate of return achieved may differ from the expected value.

The higher the value of variance and standard deviation the more risky the shares.

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Formula for variance based on expert analysis

$$\delta^2 = \sum_{i=1}^{n} p_i \times [r_i - E(r)]^2$$

δ^2 – variance

r_i – realizable rate of return i

E(r) – expected rate of return

p_i – the probability of realizing the rate of return *i*

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Formula for variance based on historical data

$$\delta^2 = \frac{\sum_{t=1}^{n}[r_t - E(r)]^2}{n-1}$$

δ^2 – variance

r_t – rate of return in the t period

E(r) – expected rate of return

n – number of periods

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Formula for standard deviation

$$\delta = \sqrt{\delta^2}$$

δ – standard deviation

δ^2 – variance

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Co-efficient of variation

A measure that can be used to compare securities from a risk point of view and the expected rate of return. When we present it in percentage, it informs us what percentage of the expected rate of return is a standard deviation.

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Formula for co-efficient of variation

$$CV = \frac{\delta}{E(r)}$$

CV– co-efficient of variation

δ – standard deviation

E(r) – expected rate of return

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Interpretation

Variance:

is not interpretable - the higher the value of variance the more risky the share

Standard deviation:

actual rate of return differs from expected rate of return for example by 0.1894

Co-efficient of variation:

co-efficient of variation informs us that standard deviation is for example 195% of expected rate of return

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Task 3

1. Estimate historical rates of return from prices, use the following formula:

$$r_t = \frac{P_t}{P_{t-1}} - 1$$

2. Calculate the expected rate of return based on the formula for the arithmetic mean

3. Estimate the level of historical return deviations from the expected rate of return

4. Square the deviation levels

5. Sum up the squares of deviations

6. Use the formula for variance, standard deviation and co-efficient of variation and calculate the measures

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