Rates of Return (Module 1.1)

1 Price, Capital Distribution and Total Return (Holding Period Return)

$$r_{price} = (P_1 - P_0) / P_0 \quad r_{distribution} = Income / P_0$$
$$r_{total} = r_{price} + r_{distribution} = (P_1 - P_0 + Income) / P_0$$

Use it when: measuring the return over one period. Distribution return = dividend yield (equity) or current yield (bond).
Example: €20 → €22 with €1 dividend: price 10% + distribution 5% = **15%**.
Watch out: always divide by the **beginning** price P_0.

2 Arithmetic Mean Return

$$R_A = (R_1 + R_2 + \ldots + R_n) / n$$

Use it when: you need the simple average of periodic returns.
Example: Acme: (-9.34% + 23.45% + 8.92%)/3 = **7.68%**.
Watch out: it assumes the amount invested never changes, so it can mislead over several periods.

3 Geometric Mean (Compound Average) Return

$$R_G = [(1 + R_1)(1 + R_2) \ldots (1 + R_n)]^{1/n} - 1$$

Use it when: you want the compound rate actually earned over several periods.
Example: Acme: $(0.9066 \times 1.2345 \times 1.0892)^{1/3} - 1$ = **6.825%**. $1,000 -25% then +25% → $937.50; arithmetic 0%, geometric **-3.175%**.
Watch out: geometric ≤ arithmetic; equal only if all returns are the same. Gap grows with variability.

4 Geometric Mean per Period vs Annual Return

Geometric mean per period: root = number of periods
Annual return: root = number of years from start to end

Use it when: holding periods are not years (e.g. semiannual, quarterly).
Example: Four 6-month returns 2.0%, 0.5%, -1.0%, 1.5%: product$^{1/4}$ - 1 = **0.7435%** per period; product$^{1/2}$ - 1 = **1.49%** per year.

5 Annualizing a Return

$$\text{Annualized return} = (1 + \text{period return})^{365/days} - 1$$
$$\text{Annualized return} = (1 + \text{period return})^{c} - 1 \ (c = \text{periods per year})$$

Use it when: comparing returns earned over different lengths of time. Works for periods shorter **or** longer than a year.
Example: 90 days: 100 → 100.75 → $(1.0075)^{365/90}$ - 1 = **3.08%**. 500-day bill 970 → 1,000: $(1.0309)^{365/500}$ - 1 = **2.25%**. Monthly 0.5% → $(1.005)^{12}$ - 1 = **6.17%**.
Watch out: annualizing assumes the period return repeats — real performance will vary.

6 Continuously Compounded (Logarithmic) Return

$$R_{cc} = \ln(1 + \text{period return}) = \ln(\text{Ending value} / \text{Beginning value})$$
$$R_{cc}(0 \to 2) = R_{cc}(0 \to 1) + R_{cc}(1 \to 2) \text{ (additive across periods)}$$

Use it when: a return is stated on a continuously compounded basis — the limit of compounding ever more frequently.
Example: $100 → $120: ln(1.20) = **18.232%**. 1,000 → 1,150 → 1,250: 13.976% + 8.338% = **22.314%**.
Watch out: continuously compounded returns **add**; ordinary (discrete) returns must be compounded.

© 2026 RBei Classes. For RBei students' personal revision only.

Components and Measures of Return (Module 1.2)

7 Nominal and Real Risk-Free Rate

$$(1 + \text{nominal } r_f) = (1 + \text{real } r_f)(1 + \text{expected inflation})$$
$$\text{Real } r_f = (1 + \text{nominal } r_f) / (1 + \text{inflation}) - 1 \approx \text{nominal } r_f - \text{inflation}$$

Use it when: separating the inflation premium from the pure time-preference return.
Example: T-bill rates are **nominal** risk-free rates: they include an inflation premium.
Watch out: required return on a risky asset = risk-free rate + risk premium(s).

8 Real Return and Excess Return

$$\text{Real return} = (1 + \text{nominal return}) / (1 + \text{inflation}) - 1$$
$$\text{Excess return} = (1 + \text{return}) / (1 + \text{benchmark return}) - 1 \approx \text{return} - \text{benchmark}$$

Use it when: measuring purchasing-power gain, or performance relative to a benchmark or reference rate.
Example: 7% nominal, 2% inflation → approx 5%, exact 1.07/1.02 - 1 = **4.9%**. 8% vs 3% benchmark → exact **4.85%**.

9 Gross Return and Net Return

$$\text{Gross return} = \text{Total return} - \text{Transaction costs}$$
$$\text{Net return} = \text{Gross return} - \text{Management and administrative fees}$$

Use it when: separating trading costs from the fees for managing the account.
Example: A 5% gain **before** commissions and fees is neither gross nor net return.
Watch out: gross return is **after** commissions on trades, **before** management fees.

10 After-Tax Nominal Return

$$\text{After-tax return} = \text{Price return} \times (1 - \text{capital gains tax}) + \text{Distribution return} \times (1 - \text{distribution tax})$$

Use it when: price gains and income are taxed at different rates.
Example: $160 → $200 plus $8 dividend; taxes 25% / 40%: pretax 25% + 5% = 30%; after-tax 25%(0.75) + 5%(0.60) = **21.75%**.
Watch out: capital gains are usually taxed only when **realized** (sold).

11 Leveraged Return

$$\text{Leveraged return} = [r_P(V_E + V_D) - r_D V_D] / V_E$$

Use it when: an investor uses borrowed money or derivatives to control more assets than their own cash.
Example: $800m own + $200m borrowed at 5%: r_P = 8% → **8.75%**; r_P = -4% → **-6.25%**.
Watch out: leverage magnifies **losses** as well as gains.

BA II Plus — roots and logs: cube root of 1.21903: 1.21903 [y^x] 3 [1/x] [=] then - 1. Continuously compounded return: 1.20 [LN] = 0.18232. Annualize: 1.0075 [y^x] (365 ÷ 90) [=] - 1.

© 2026 RBei Classes. For RBei students' personal revision only.