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Discounted Cash Flows

Stock returns

- Returns on investments consist of capital gains and dividend payments
- $R_{t+1} = \frac{P_{t+1} - P_t}{P_t} + \frac{D_{t+1}}{P_t}$
$\Rightarrow$ $P_t = \frac{P_{t+1} + D_{t+1}}{1 + R_{t+1}}$
- The current price should then be the present value of the future price and any dividends obtained
- As the future stock prices and dividends are not known, we need to form expectations
$\Rightarrow$ $P_t = \frac{\mathsf{E}[P_{t+1}] + \mathsf{E}[D_{t+1}]}{1 + \mathsf{E}[R_{t+1}]}$
- In efficient markets expected returns are not changing: $\mathsf{E}[R_{t+1}] = \mathsf{E}[R_t] = \mu$
$\Rightarrow$ $P_t = \sum_{\tau=1}^{T} \frac{\mathsf{E}[D_{t+\tau}]}{(1+\mu)^\tau} + \frac{\mathsf{E}[P_{t+T}]}{(1+\mu)^T}$
- The stock price should be the present value of future dividends and the final value

Stock value with an infinite time horizon

- We assume that stock prices increase less than their expected returns
- This is the case if the dividends are paid out regularly, reducing the stock price after every payment

$\Rightarrow \lim_{T \to \infty} \frac{\mathsf{E}[P_{t+T}]}{(1+\mu)^T} = 0$

$\Rightarrow P_t = \sum_{\tau=1}^{\infty} \frac{\mathsf{E}[D_{t+\tau}]}{(1+\mu)^\tau}$

- If the time horizon is infinite, the stock value is the present value of future dividends
- The discount rate is the expected stock return

Constant dividends

- We need to form expectations about future dividends
- Assume for now that dividends are constant and at the current level:
  $\mathsf{E}\left[D_{t+\tau}\right] = D_t$
- $\Rightarrow P_t = \frac{D_t}{\mu}$
- If we assume that earnings are paid out fully, then we can identify dividends with earnings
- The price-earnings ratio is given by $\frac{P_t}{D_t} = \frac{1}{\mu}$
- Using the price-earnings ratio from the market we can determine which discount rate the market applies

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Gordon growth model

- We can assume that dividends are growing at a constant rate every time period
- $E[D_{t+\tau+1}] = (1+g)E[D_{t+\tau}] = (1+g)^{\tau+1}D_t$
- $\Rightarrow P_t = \frac{1+g}{\mu-g}D_t$
- For a feasible solution we require that $g < \mu$
- The dividends cannot grow too fast, otherwise the present value of future dividends grows ever larger and the stock value is infinite
- The price-earnings ratio is given by $\frac{P_t}{D_t} = \frac{1+g}{\mu-g}$

- The stock price will depend on the assumptions on the growth rate and discount rate
- $\frac{\partial P_t}{\partial g} = \frac{1+\mu}{(\mu-g)^2} D_t$
- The price is very sensitive to the growth rate, especially if it is close to the discount rate
- Small changes in growth expectations or the applied discount rate can affect the stock value significantly

Determination of the discount rate

- ▶ The discount rate was identified as the expected stock return
- ▶ This can be determined by asset pricing models
- ▶ Most common is to use the Capital Asset Pricing Model

- ▶ Rather than dividends, it is common to use earnings in determining stock values
- ▶ If we assume that retained earnings are re-invested and generate the same return as existing investments, dividend payments are irrelevant
- ▶ The value of retained earnings is accumulated in the stock price, giving the same return to investors

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