## 11 Forward and Futures

**Forward Interest rates**

The forward interest rate between time $t-1$ and $t$ satisfies:

$$(1 + r_t)^t = (1 + r_{t-1})^{t-1}(1 + f_t)$$

$$f_t = \frac{B_{t-1}}{B_t} - 1 = \frac{(1+r_t)^t}{(1+r_{t-1})^{t-1}} - 1$$

**Forward price**

$$F_T = e^{(r-y)T} S_0$$

**Swaps**

The swap rate is a weighted average of forward rates:

$$r_s = \frac{\sum_{t=1}^{T} B_t f_t}{\sum_{u=1}^{T} B_u} = \sum_{t=1}^{T} w_t f_t \quad , \text{ with the}$$

weights $w_t$ $\frac{B_t}{\sum_{u=1}^{T} B_u}$