

Tutorial 10 - Oct-2018

Financial	Commodity	
income	income	Common
- dividend	- Convenience yield	

Expenses

X

Storage cost

$$F_{0,T} = S_0 e^{(r-\delta)T}$$

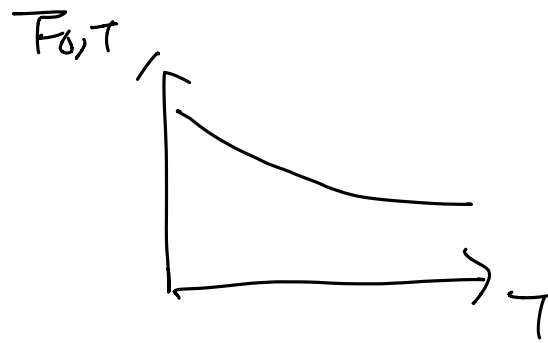
↳ cts

↳ discrete

Contango

Vs

Backwardation



Expenses of Asset owner $\Rightarrow \uparrow F_{0,T}$

Income of Asset owner $\Rightarrow \downarrow F_{0,T}$

$$F_{0,T} = (S_0 + \text{PV(all storage cost)}) e^{rT} \quad \text{or}$$

$$= S_0 e^{(r+u)T}$$

$$F_{0,T} = (S_0 + u - \overset{\text{PV (all Convenience)}}{\textcircled{y}}) e^{rT}$$

$$\text{or} = \boxed{S_0 e^{(r+u-y)T}}$$

$$\text{Lease} = \text{benefit}$$

$$= \text{convenience} - \text{storage}$$

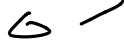
$$\text{Lease rate} = \frac{\text{convenience}}{\text{yield}} - \text{storage cost.}$$

(Cts compounding)

Synthetic Forward

$$\text{Payoff of Forward} = S_T - K \quad \text{Cash}$$

$$= \textcircled{S_T} - \underbrace{\left(S_0 + \text{PV}(\text{Storage}) \right) e^{rT}}_{\text{At maturity}}$$

Underlying


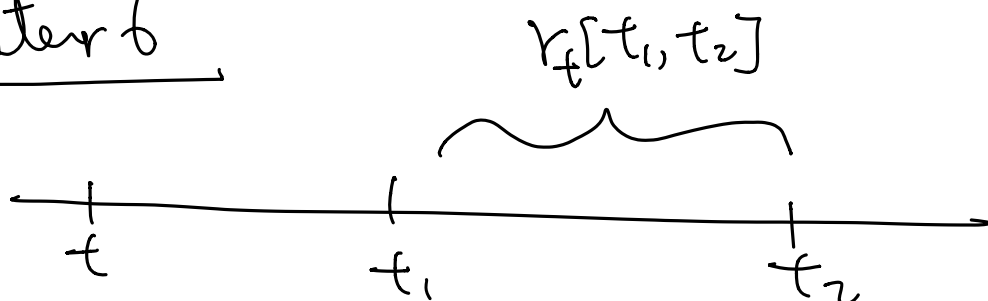
At maturity

At t=0

Buy 1 unit of
Commodity

+ borrow money
 * S_0 at $t=0$
 * Storage cost at t_i

Chapter 6



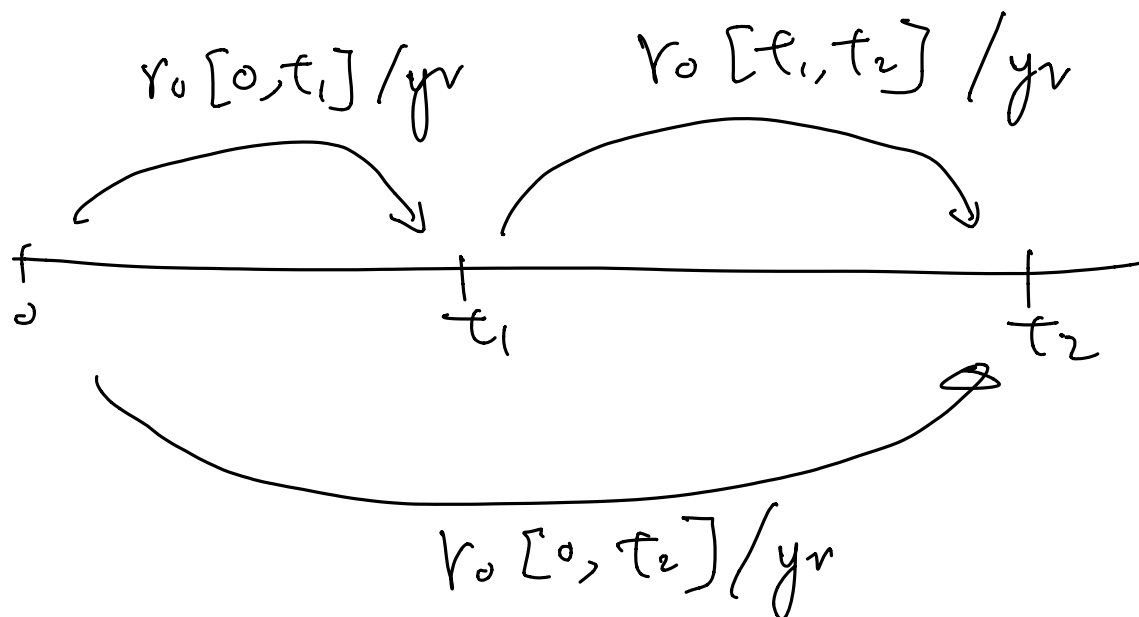
$$r[t_1, t_2] \equiv r_{t_1}[t_1, t_2]$$

$r(0, t_1)$: zero-coupon yield of t_1 -year
zero-coupon bond

$$P(0, t_1) = \frac{1}{(1 + r(0, t_1))^{t_1}} = e^{-r(0, t_1)t_1}$$

Implied forward rate

$r_0[t_1, t_2]$ deterministic



≈ 1

?

$$\tilde{B}(0, \tau) = \underbrace{\sum_{i=1}^n \tilde{C} P(0, t_i) + 1 P(0, t_n)}_{\text{portfolio of zero-coupon bonds}}$$