Money	Asset	Name	Price
O	O	outright purchase	S_0
O	T	Prepaid Forward	S_0
T	O	Fully-leveraged Purchase	$S_0 e^{rT}$
T	T	Forward	$S_0 e^{rT}$

Futures vs. Forwards

1) Contracts are standardized

2) Traded on an exchange
   - market makers
   - stop trading if there is a bubble

3) Financial Settlement

$$\overset{-1}{F_{0,T}} - \overset{1}{S_T}$$

Buyer → Seller

say
$F_{0,T} = 2$
$S_T = 3$

$\overset{1}{S_T}\underset{3}{}$ asset

asset S_T 1
3

$F_{0,T} = 2$
$S_T = 1$
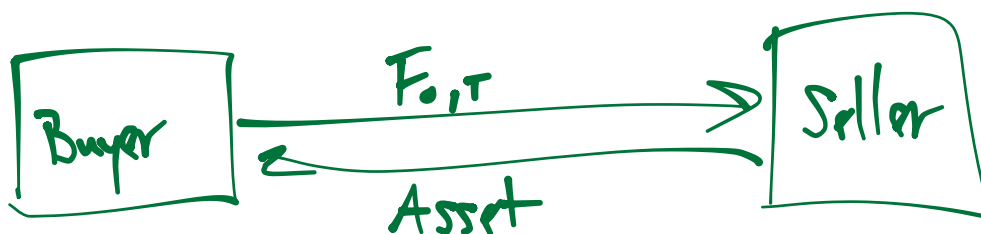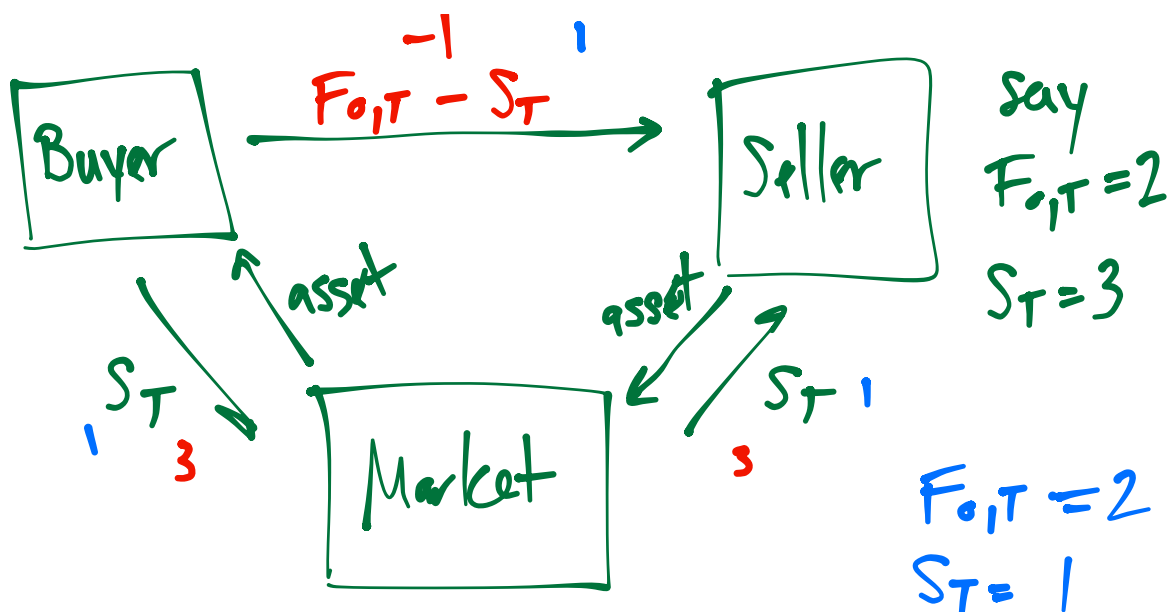
Market

4) Margin Accounts & Mark-to-Market

Exchange Futures

x_0 — exchange rate at $t = 0$

e.g. $\dfrac{\$1}{¥120}$

$r_\$ = 5\%$ $r_¥ = 10\%$
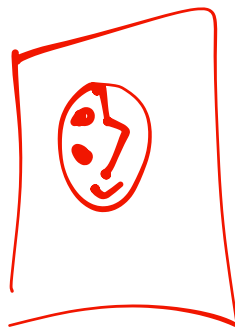
I want ¥100 at $t = 1$. How can I arrange that?

Action	$ $ $ t=0	¥	$ $ $ t=1	¥
Buy ¥	-0.7540	+90.4837		
Borrow $	0.7540		-0.7927	
Lend ¥		-90.4837		+100

0   0   -$.7927   +¥100

$$F_{0,1} = S_0 e^{(r-\delta)T}$$

$$F_{0,1} = X_0 e^{(r_\$ - r_¥)T}$$

Arbitrage - a risk-free profit

Subjective

-art

trash!

Objective

Pepsi Points → Harrier Jet

EX 5.7

a) $F_{0,.5} = S_0 e^{(r-\delta)T}$

$= 1100\, e^{(.05-0)(.5)}$

$= 1127.85$

Action	$t=0$	$t=0.5$
Short Fwd	0	$+1135 - \cancel{S_T}$
Buy Asset	-1100	$\cancel{S_T}$
Borrow	1100	-1127.85
	0	7.15

b)

Action	$t=0$	$t=0.5$
Long Fwd	0	$-1115 + S_T$

| Short Asset | + 1100 | − S_T |
| Lend | − 1100 | + 1127.85 |

12.85

Efficient Market Hypothesis

- Prices are set by the market based on available information.

Weak EMH: All past information is incorporated into stock prices. i.e. there are no patterns to be found in stock charts

Semi-strong: Prices reflect all publicly available information. Implies that price adjustments based on news happen immediately.

Strong: Prices reflect any information that could be obtained by analysis or private information.

Implies there is no such thing as a "good" investor.

If (as we will assume) the EMH is true, then the next price change for any asset will be random. We should not be able to predict size or direction.

Price movements are sometimes

Options

T   expiration date

K   strike price (like a forward price, but can be chosen rather than determined by formula.
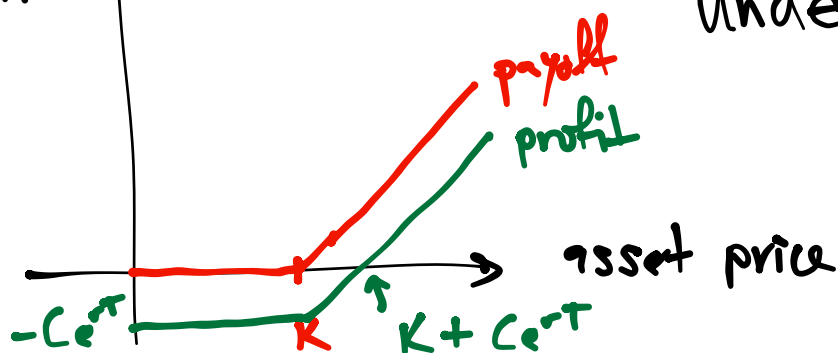
If at time t, $S_T > K$, then a call option owner can exercise to buy at a discount.
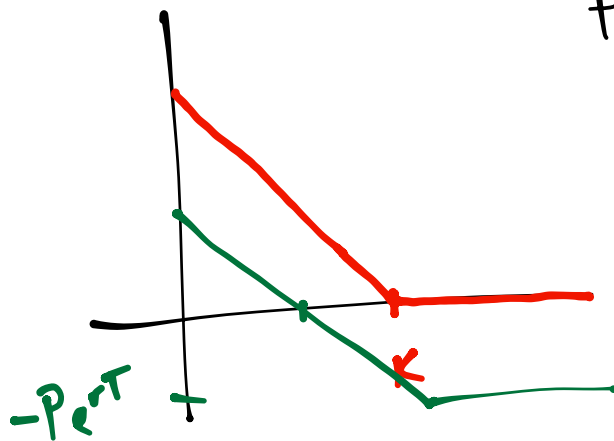
If $S_T \leq K$, call owner can choose to do nothing.

Call Option – option to buy the underlying asset

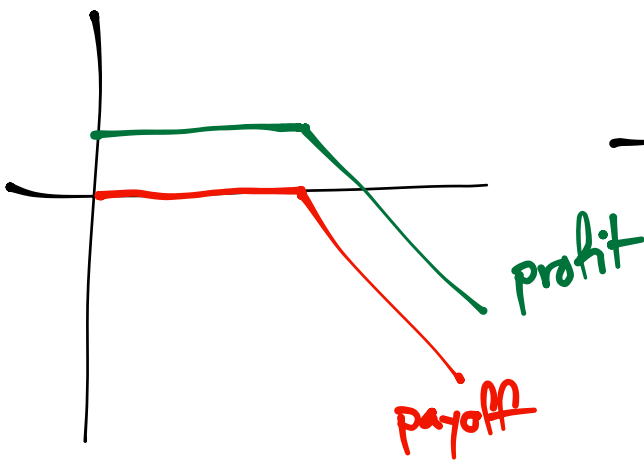payoff/profit (vertical axis)

payoff (red curve)

profit (green curve)

asset price (horizontal axis)

$-Ce^{rT}$

K

$K + Ce^{-T}$

Put Option - option to
sell the underlying
asset.

written call

$-Pe^{rT}$

K

written put

profit

payoff

Action	$t=0$	$t=T$	
		$S_T < K$	$S_T \geq K$
Buy Call	$-C$	0	$S_T - K$
Barrow	C	$-Ce^{rT}$	$-Ce^{rT}$
		$Max(0, S_T - K) - Ce^{rT}$	

"Bullish" positions

long fwd

call

written put

"Bearish" positions

put

written call

short