2. Forwards and Options

Risk - sharing.

- diversifiable risk
- non-diversifiable risk.

Derivative

Agreement between two people.

Bid - Ask spread.

ask price - price you can buy.

bid price - price you can sell.

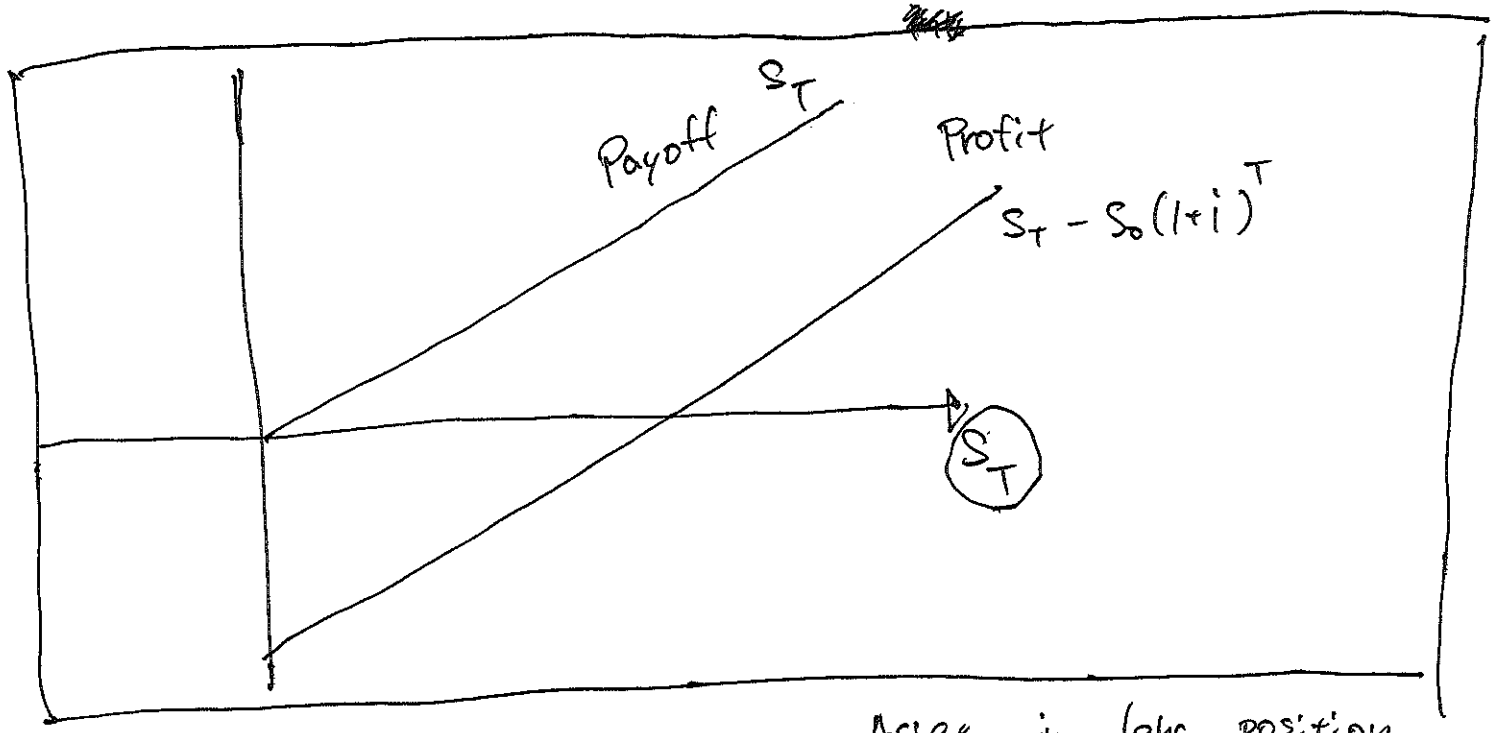
Definition:

Financial position - any combination of investments. (long, short, risk-free, borrowing)

Payoff vs Profit

Payoff = value of asset at time T.

Profit = Payoff − what you would have made in 'risk-free' rate



payoff diagram.

Financial Derivative

→ Forward (Future) Contract — buy/sell on future date.

→ Option — option to buy (Call option)

option to sell (put option)

- American (by the due date)
- European (on the)
- Bermudian (middle some date)

Assumption:

1. there's always "risk-free" rate of return

2. Any asset can be purchased long or sold short.

Forward Contract

- agreement to buy/sell asset
  on delivery date
  at delivery price.

→ Must happen. Can't cancell.

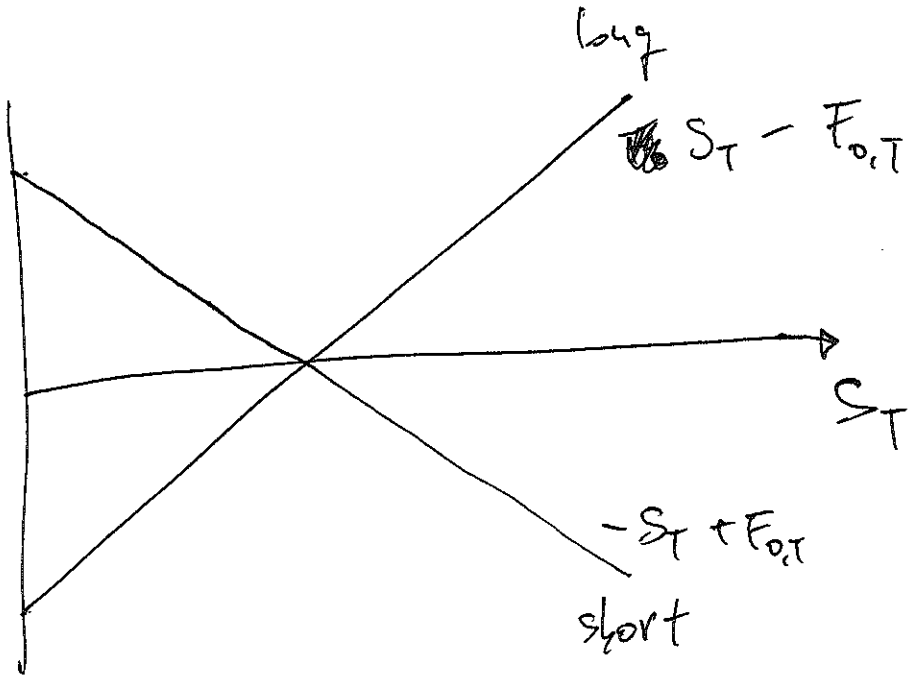
→ No premiums. (no initial cost)

→ Underlying asset :

long position – will get an asset on d-date

short position – will get paid on d-date.

Payoff of Future Contract (same as profit)



→ $F_{0,T}$: Delivery price.

→ (long position) = − (short position)

Example

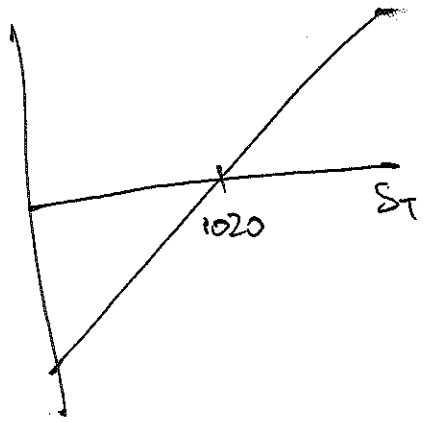
long Future contract with $1020 delivery price, 1 yr delivery date

same as

long asset bought $1000. annual risk-free rate 2%

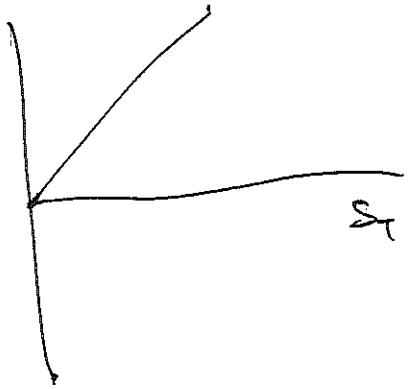
Future

payoff/profit

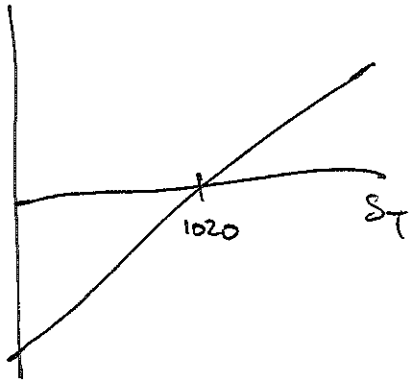


Asset

Payoff



Profit



Credit Risk

- Risk that the other party fails to meet the agreement.

Call Options

gives option holder right to buy Specified amount of underlying asset from issuer.

- Strike price (exercise price)
- Expiration date

American - any time up to E-date

European - only on E-date

Bermudian - set number of dates.

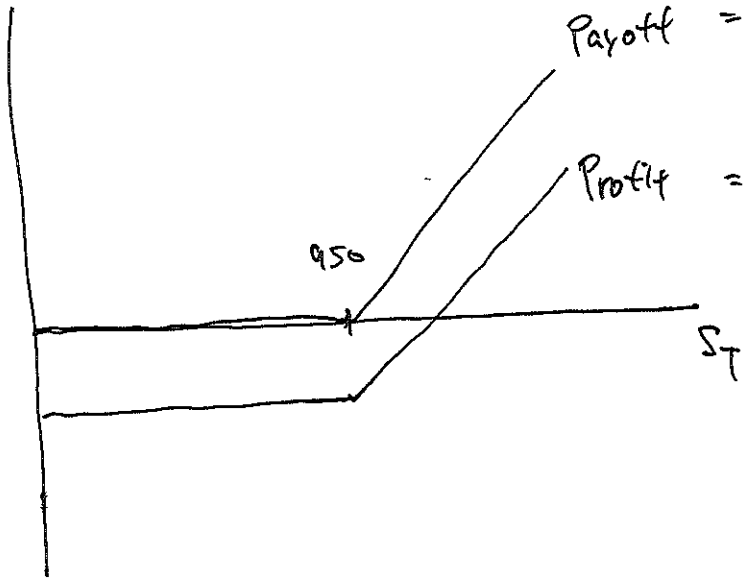
Ex

long position

Call option 1 yr at $950

premium = $30 (pay)

risk-free rate 3%.



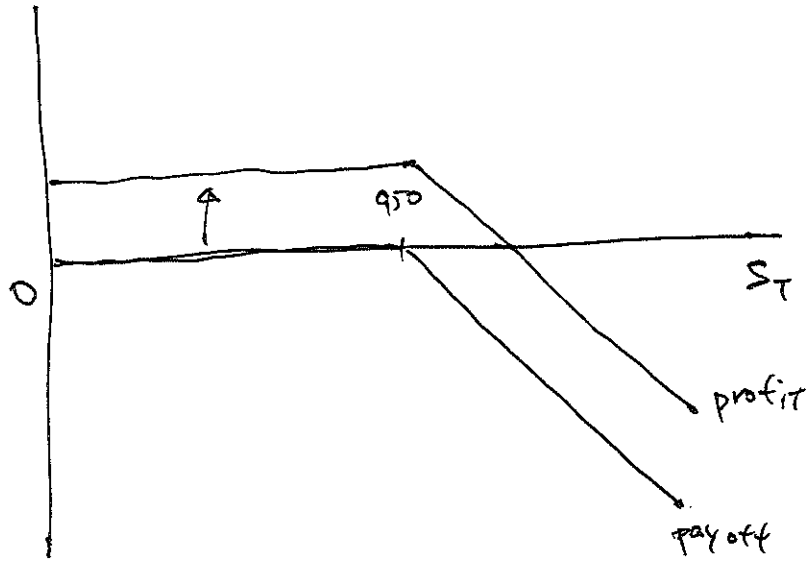
$$\text{Payoff} = \max\{S_1 - 950,\ 0\}$$

$$\text{Profit} = \max\{S_1 - 950,\ 0\} - 30(1.03)$$

Written Call Option

= Short position in call option.

Receive Premium ($30)



$$\text{profit} = -\max\{S_1 - 950, 0\} + 30(1.03)$$

$$\text{payoff} = -\max\{S_1 - 950, 0\}$$

Put Option

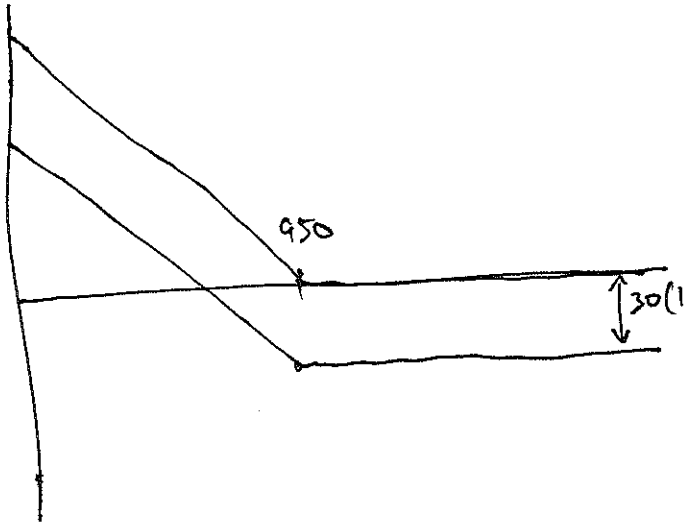
→ Option to sell

(purchased)

Ex. long put 1 yr at $950

premium = $30

risk-free rate 3%

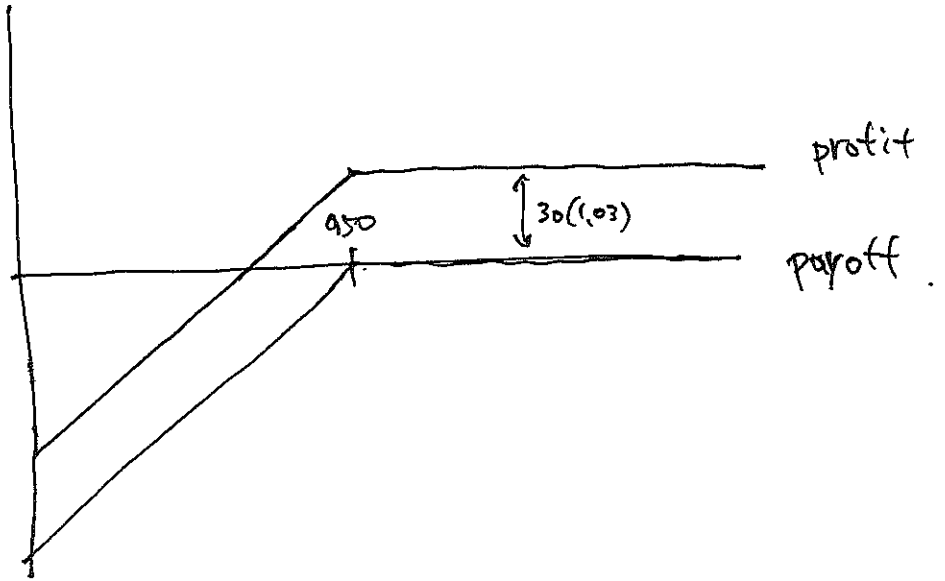


pay off = $\max\{950 - S_1, 0\}$

profit = $\max\{950 - S_1, 0\} - 30(1.03)$

Written Put Option

= short pos. on put



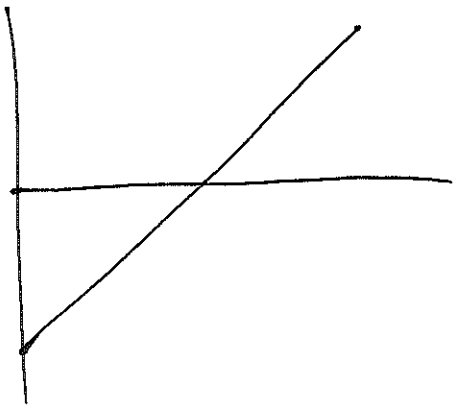
'Moneyness'

	If you exercise immediately you would make payoff of.
in-the-money	positive
out-of-the-money	negative
at-the-money	zero

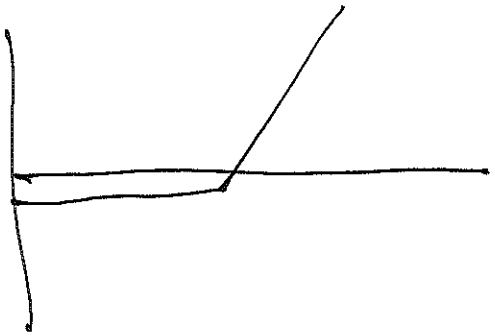
Payoff Diagram

Long

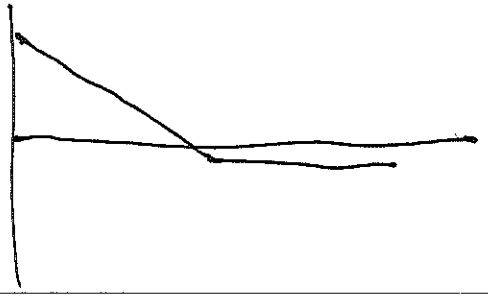
Forward



Call

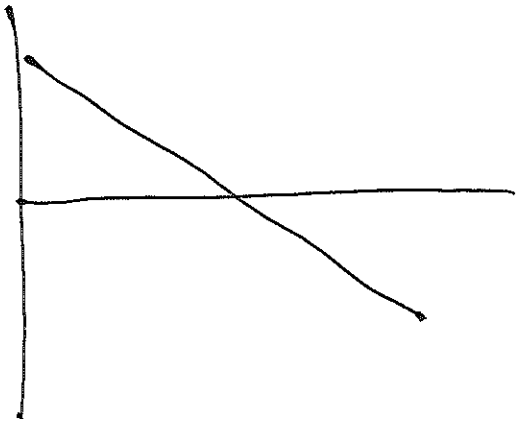


Put



Short

Fwd



Call

Put