Options, Futures and other Derivatives

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Monday, Tuesday and Thursday

YOU WILL NEED A **CALCULATOR**

http:// webintec.ceram.fr

WHAT DO YOU EXPECT TO LEARN IN THIS CLASS ?

INTRODUCTION

The Nature of Derivatives

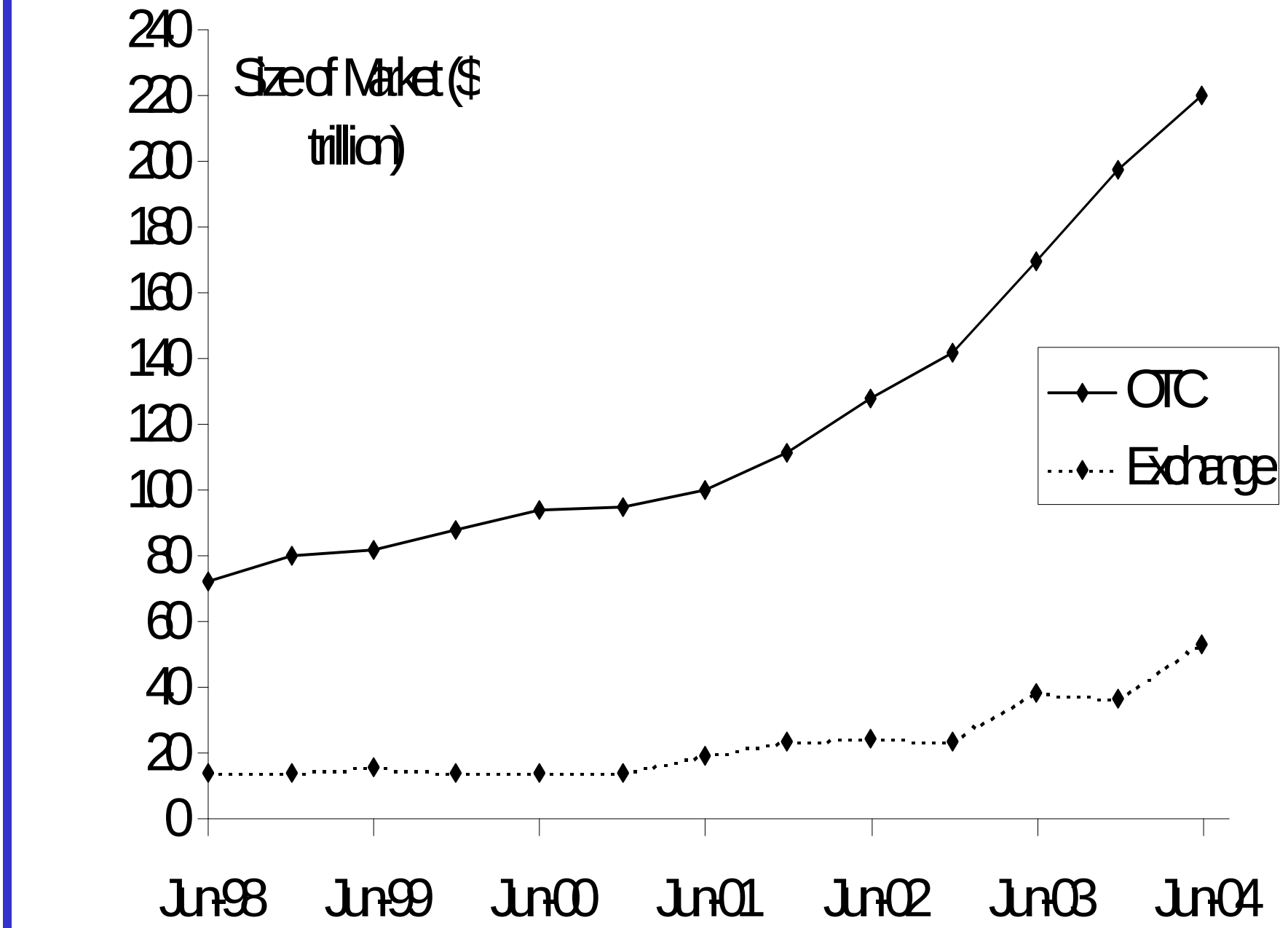
A derivative is a financial instrument whose value depends on the values of other more basic underlying variables

Examples of Derivatives

- Forward Contracts
- Options
- Futures Contracts
- Swaps
- Credit Derivatives (CDS , CDOs)

Derivatives Markets

- Exchange Traded (futures,options)
  - standard products
  - trading floor
  - virtually no credit risk
- Over-the-Counter (forwards, swaps,options,CDS)
  - non-standard products
  - telephone market
  - some credit risk


Size of Market ($ trillion)
240
220
200
180
160
140
120
100
80
60
40
20
0
Jun-98
Jun-99
Jun-00
Jun-01
Jun-02
Jun-03
Jun-04
OTC
Exchange

Ways Derivatives are Used

- To hedge risks
- To reflect a view on the future direction of the market
- To lock in an arbitrage profit
- To change the nature of a liability
- To change the nature of an investment without incurring the costs of selling one portfolio and buying another

Forward Contracts

- A forward contract is an agreement to buy or sell an asset at a certain time in the future for a certain price (the delivery price)
- It can be contrasted with a spot contract which is an agreement to buy or sell immediately

How a Forward Contract Works

- The contract is an over-the-counter (OTC) agreement between 2 companies
- The delivery price is usually chosen so that the initial value of the contract is zero
- No money changes hands when contract is first negotiated and it is settled at maturity

The Forward Price

- The forward price for a contract is the delivery price that would be applicable to the contract if it were negotiated today

- The forward price may be different for contracts of different maturities(depending on…?) %

The Forward Price of Gold

If the spot price of gold is S and the theoretical forward price for a contract deliverable in T years is F, then

$F = S(1+rt)$ *when < 1 year*

$F = S(1+r)^t$ when > 1 year

where r is the 1-year (domestic currency) risk-free rate of interest.

In our examples, S=875, T=1, and r=0.05 so that

$F = 875\ [(1+(0.05 \times 1)] = \$918.75$

1. Gold: An Arbitrage Opportunity?

- Suppose that:
  - The spot price of gold is US$875
  - The 6-month forward price of gold trades at US$895 on the market
  - The 1-year US$ interest rate is 5% per annum
- Is there an arbitrage opportunity?

What is arbitrage ?

A transaction that generates risk free profit

The theoretical forward price is :

$$875 (1 + 0.05x0.5) = \$896.88$$

Buy Future and Sell the Spot

The theoretical price is not a price you can trade on

2. Gold: Another Arbitrage Opportunity?

- Suppose that:
  - The spot price of gold is US$750
  - The 1-year forward price of gold is US$768
  - The 1-year US$ interest rate is 5% per annum
- Is there an arbitrage opportunity?

What 2-year forward price would eliminate any arbitrage possibility?

$$750\,(1 + 0.05)^2 = \$827$$

If the 2-year forward rate on gold is \$827, there would Not be any arbitrage opportunities.

Terminology

- The party that has agreed to buy has what is termed a long position **(going LONG)**
- The party that has agreed to sell has what is termed a short position **(going SHORT)**

IN GENERAL, THE PAYOFF FROM A LONG POSITION IN A FORWARD CONTRACT ON ONE UNIT OF AN ASSET IS

F - S

IN GENERAL, THE PAYOFF FROM A SHORT POSITION IN A FORWARD CONTRACT ON ONE UNIT OF AN ASSET IS

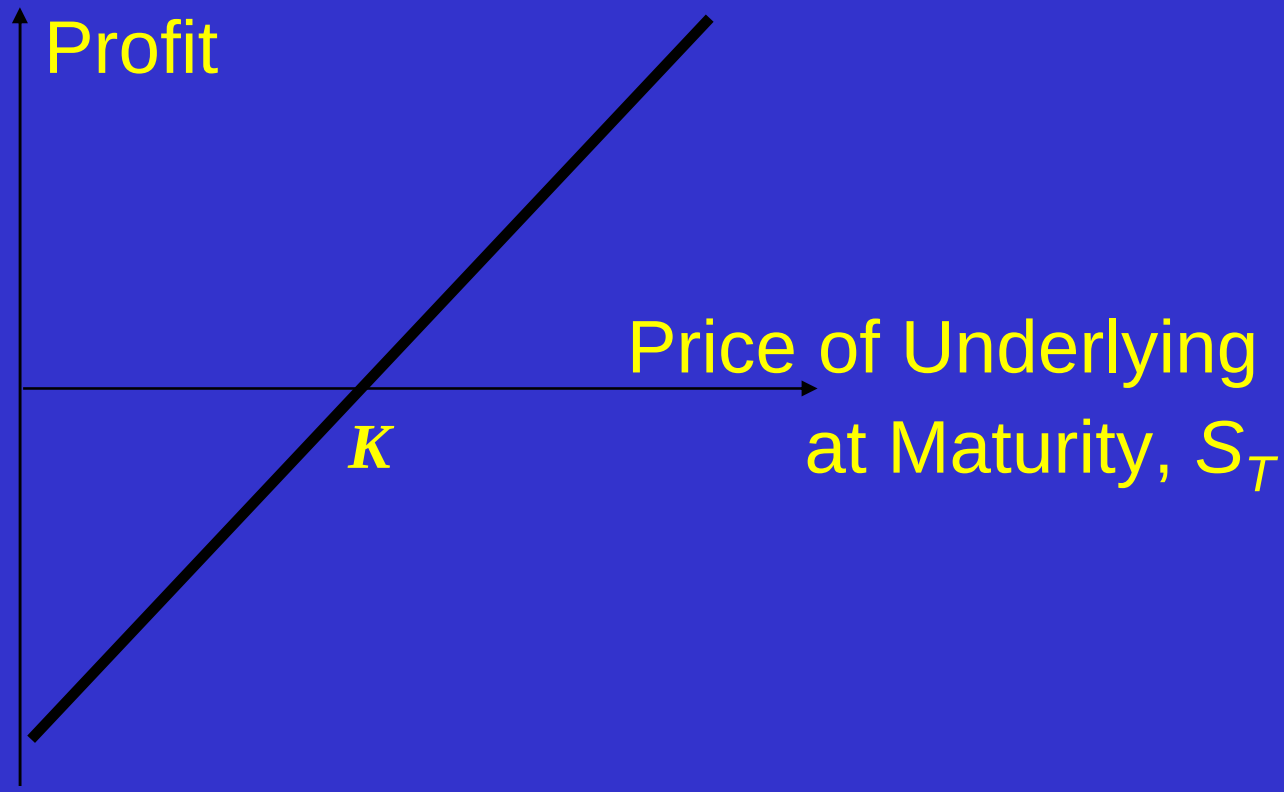
S - F

(F IS THE DELIVERY OR FORWARD PRICE AND S IS THE SPOT PRICE)

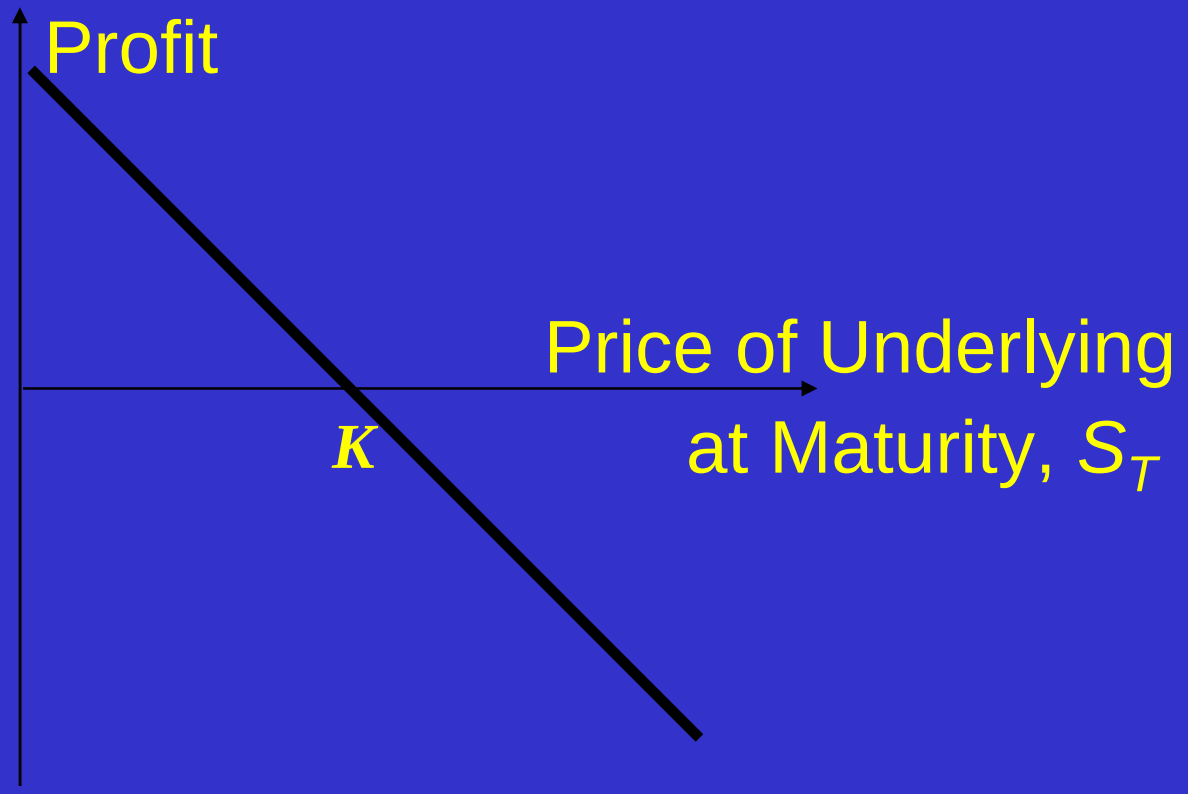
Example

- On Sept 25, 2007 a trader enters into an agreement to buy €1 million in 3 months at an exchange rate of $1.4720 (F)
- This obligates the trader to pay $1,472,000 for €1 million on December 25, 2007
- What are the possible outcomes?

Profit from a Long Forward Position



Profit from a Short Forward Position



THIS IS IT FOR

FORWARDS

OK?

NOT OVER YET ….

A speculator thinks the dollar will go back up in the next 3 months. What can he do, using the forward market?

GOES LONG OR BUYS DOLLAR FORWARD

THE DOLLAR/EURO RATE IS AT **1.47** TODAY
(that is \$1.47 for 1 €).

You decide to buy 3-months forward 1 Million euros.

What is his profit/loss if the Dollar/EURO rate goes to…

You are buying €1 million that is selling \$1,470,000

1.45 ? 1.45 - 1.47 = 0.02 * 1MM= \$20 000

1.41 ? 1.41 - 1.47 = **-** 0.06*1MM = **-** \$60 000

WELCOME TO THE WORLD OF

FUTURES

AN ANXIOUS TRADER

CHICAGO (CBOT)

Futures Contracts

- Agreement to buy or sell an asset for a certain price at a certain time
- Similar to forward contract
- Whereas a forward contract is traded OTC a futures contract is traded on an exchange

Exchanges Trading Futures

- Chicago Board of Trade (grains, bonds)
- Chicago Mercantile Exchange(curr.)
- New York Cotton Exchange
- International Petroleum Exchange (IPE)
- LIFFE (London)
- TIFFE (Tokyo)
- and many more...

1. Oil: An Arbitrage Opportunity?

Suppose that:

- The spot price of oil is US$106
- The quoted 1-year futures price of oil is US$
- The 1-year US$ interest rate is 5% per annum
- The storage costs of oil are $2 per annum

- Is there an arbitrage opportunity?

2. Oil: Another Arbitrage Opportunity?

- Suppose that:
  - The spot price of oil is US$80
  - The quoted 1-year futures price of oil is US$75
  - The 1-year US$ interest rate is 5% per annum
  - The storage costs of oil are $2 per annum
- Is there an arbitrage opportunity?

MORE IN-DEPTH ANALYSIS OF

FUTURES

NEXT WEEK ...

Options

- A call option is an option to buy a certain asset by a certain date for a certain price (the strike price)
- A put option is an option to sell a certain asset by a certain date for a certain price (the strike price)

Exchanges Trading Options

- Chicago Board Options Exchange
- American Stock Exchange
- Philadelphia Stock Exchange
- Pacific Stock Exchange
- European Options Exchange
- Australian Options Market
- and many more (see list at end of book)

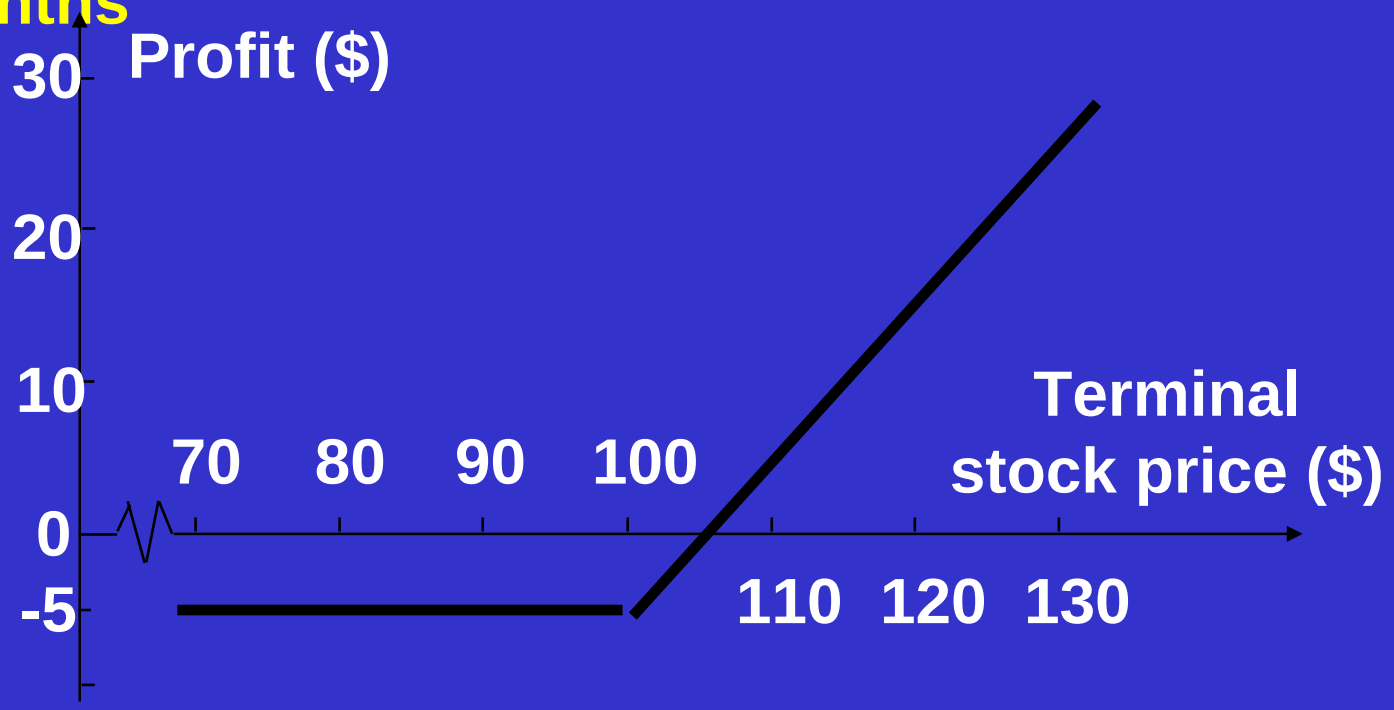
Difference betwen an option and a forward (or futures) contract ?

Options vs Futures/Forwards

- A futures/forward contract gives the holder the obligation to buy or sell at a certain price
- An option gives the holder the right to buy or sell at a certain price

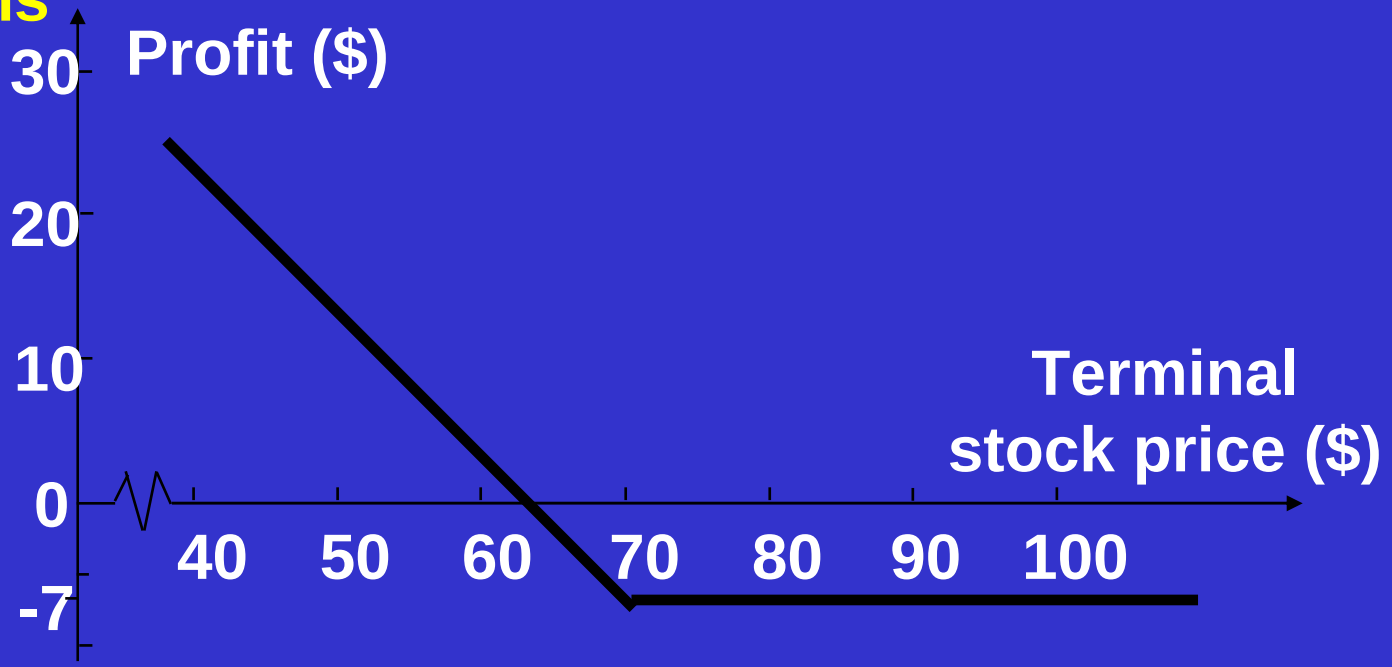
Long Call on IBM

Profit from buying an IBM European call option: option price = $5, strike price = $100, option life = 2 months



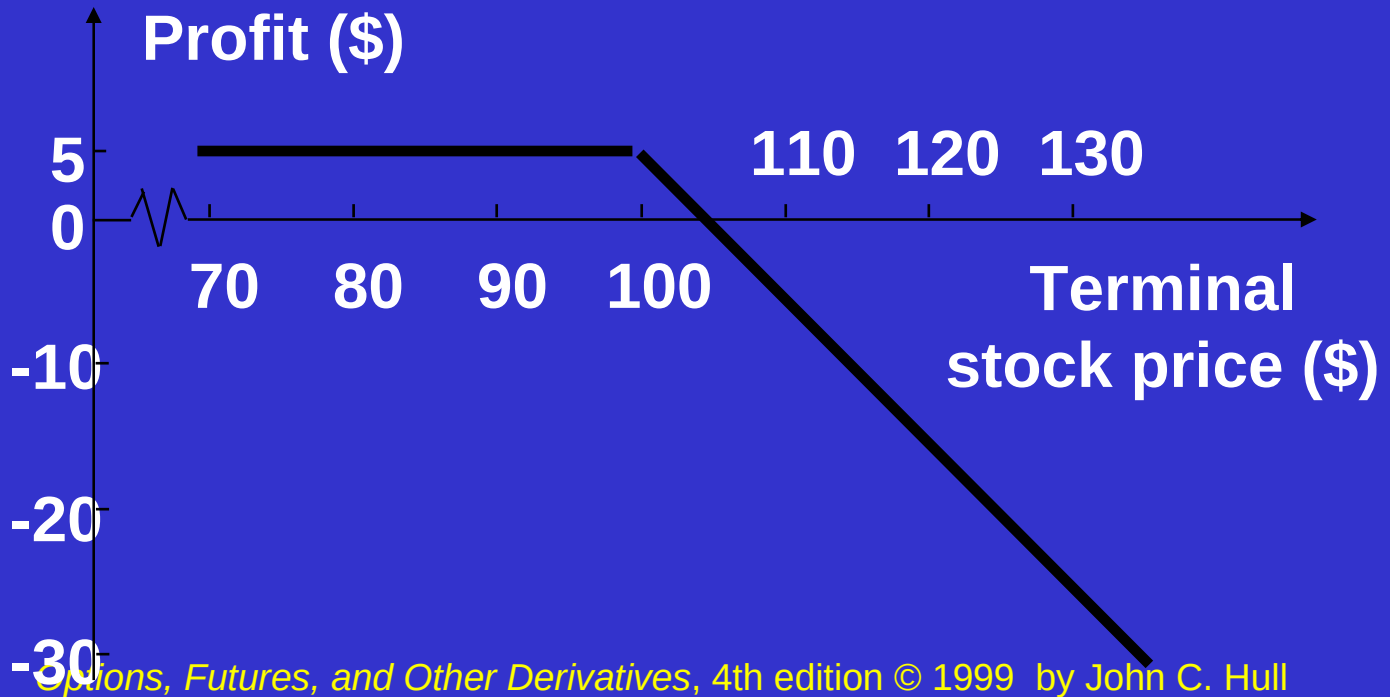
Long Put on Exxon

Profit from buying an Exxon European put option: option price = $7, strike price = $70, option life = 3 mths



Short Call on IBM

Profit from writing an IBM European call option: option price = $5, strike price = $100, option life = 2 months



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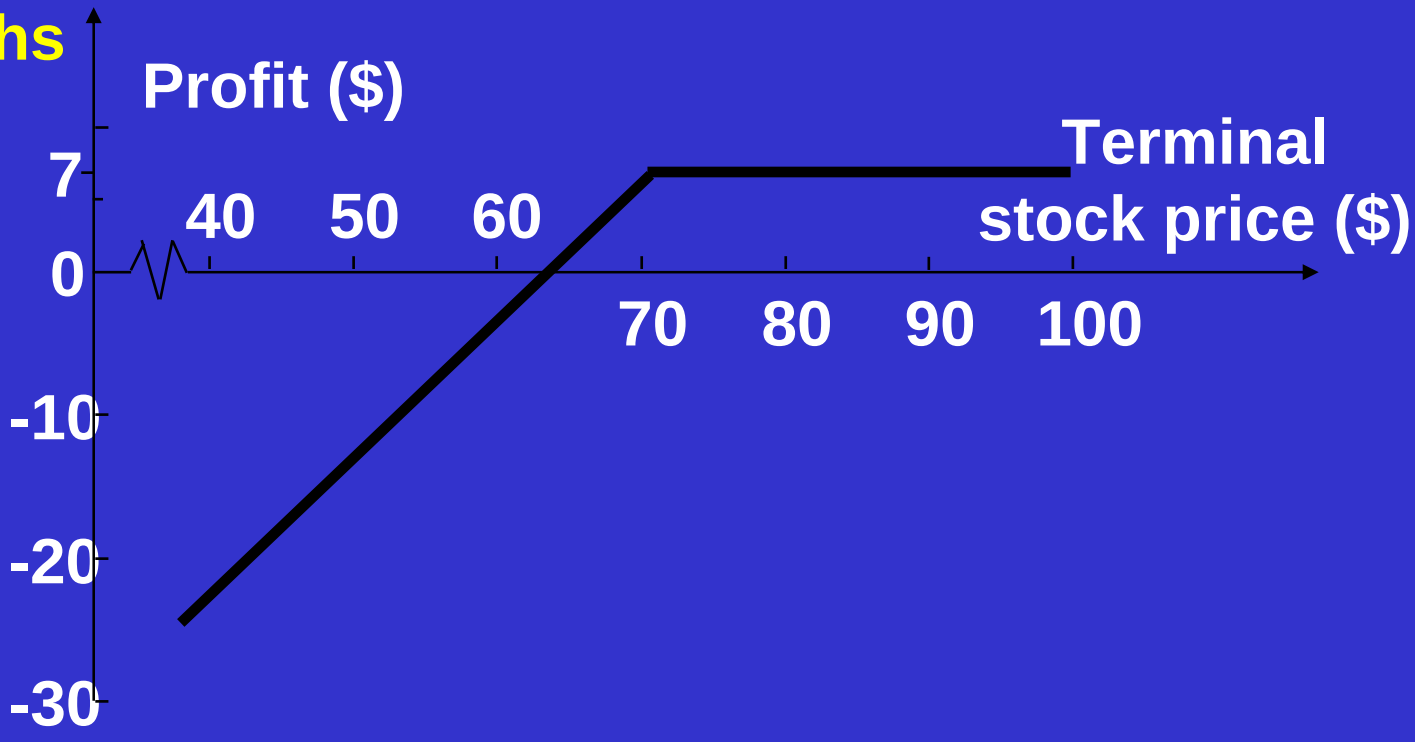
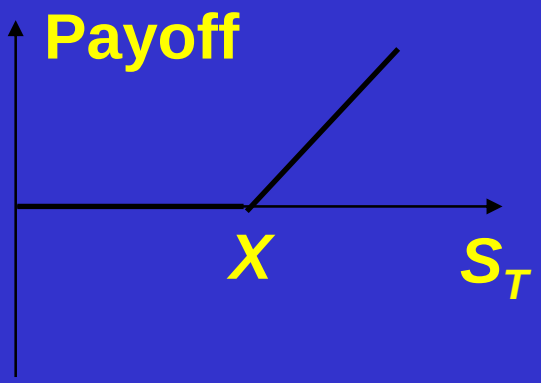
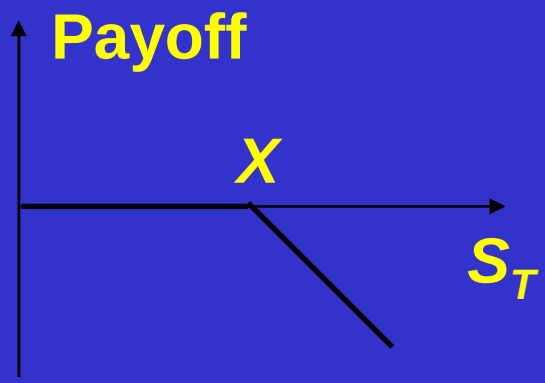


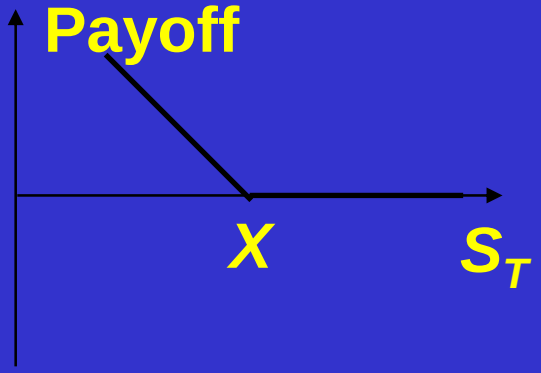
Payoffs from Options

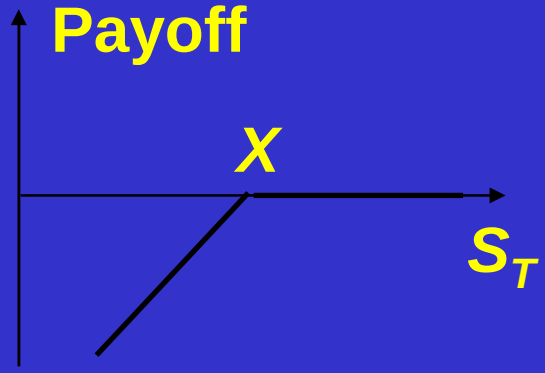
What is the Option Position in Each Case?

X = Strike price, S_T = Price of asset at maturity









Types of Traders

- Hedgers
- Speculators
- Arbitrageurs

Some of the large trading losses in derivatives occurred because individuals who had a **mandate** to hedge risks switched to being speculators (Barings case)

Hedging Examples

- A US company will pay £1 million for imports from Britain in 6 months and decides to hedge using a long/short position in a forward contract ? long
- An investor owns 500 IBM shares currently worth $95 per share. A two-month put with a strike price of $90 costs $2. The investor decides to hedge by buying/selling 5 puts ? buy

Speculation Example

- An investor with $7,800 to invest feels that Exxon's stock price will increase over the next 3 months. The current stock price is $78 and the price of a 3-month call option with a strike of 80 is 3 (which means $300)
- What are the alternative strategies?

OUTCOME

STRATEGY	70	90
BUY SHARES	(800)	**1200**
BUY CALL OPTIONS	(7800)	**18,200**
		

[(90-80)x2600]-7800

Arbitrage Example

- A stock price is quoted as £100 in London and $200 in New York
- The current exchange rate is 1.90 dollars per pound
- What is the arbitrage opportunity?

YOU BUY THE STOCK IN London at $190 DOLLARS

AND

YOU SELL IT IN NY AT $200 DOLLARS

NET PROFIT = 10 DOLLARS/SHARE

Hedge Funds vs. mutual funds

- Hedge funds are not subject to the same rules as mutual funds and cannot offer their securities publicly.
- Mutual funds must
  - disclose investment policies,
  - makes shares redeemable at any time,
  - limit use of leverage
  - take no short positions.
- Hedge funds are not subject to these constraints.
- Hedge funds use complex trading strategies are big users of derivatives for hedging, speculation and arbitrage

BREAK TIME !