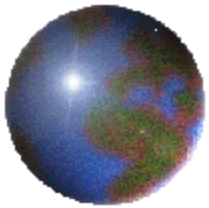
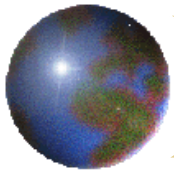


Chapter 1
Introduction to Financial Derivatives



What is a Derivative?

- A derivative is an instrument whose value depends on, or is derived from, the value of another asset.
- Examples: futures, forwards, swaps, options, exotics…

Why Derivatives Are Important

- Derivatives play a key role in transferring risks in the economy
- The underlying assets include stocks, currencies, interest rates, commodities, debt instruments, electricity prices, insurance payouts, the weather, etc
- Many financial transactions have embedded derivatives
- The real options approach to assessing capital investment decisions has become widely accepted

How Derivatives Are Traded

- On exchanges such as the Chicago Board Options Exchange (CBOE)
- In the over-the-counter (OTC) market where traders working for banks, fund managers and corporate treasurers contact each other directly

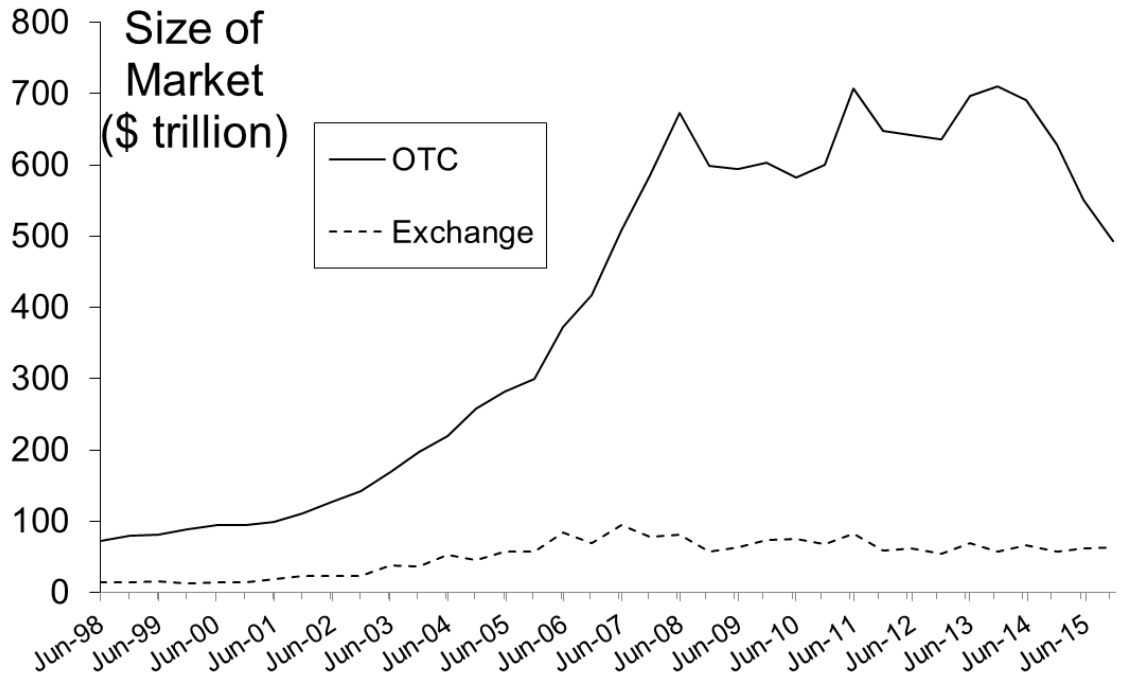
The OTC Market Prior to 2008

- Largely unregulated
- Banks acted as market makers quoting bids and offers
- Master agreements usually defined how transactions between two parties would be handled
- But some transactions were cleared through central counterparties (CCPs). A CCP stands between the two sides to a transaction in the same way that an exchange does

Since 2008…

- OTC market has become regulated. Objectives:
  - Reduce systemic risk (see Business Snapshot 1.2, page 5)
  - Increase transparency
- In the U.S and some other countries, standardized OTC products must be traded on swap execution facilities (SEFs) which are electronic platforms similar to exchanges
- CCPs must be used to clear standardized transactions between financial institutions in most countries
- All trades must be reported to a central repository

Size of OTC and Exchange-Traded Markets
(Figure 1.1, Page 5)



Source: Bank for International Settlements. Chart shows total principal amounts for OTC market and value of underlying assets for exchange market

The Lehman Bankruptcy (Business Snapshot 1.1)

- Lehman's filed for bankruptcy on September 15, 2008. This was the biggest bankruptcy in US history
- Lehman was an active participant in the OTC derivatives markets and got into financial difficulties because it took high risks and found it was unable to roll over its short term funding
- It had hundreds of thousands of transactions outstanding with about 8,000 counterparties
- Unwinding these transactions has been challenging for both the Lehman liquidators and their counterparties

How Derivatives are Used

- To hedge risks
- To speculate (take 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

Foreign Exchange Quotes for GBP, May 3, 2016 *(See page 6)*

	Bid	Offer
Spot	1.4542	1.4546
1-month forward	1.4544	1.4548
3-month forward	1.4547	1.4551
6-month forward	1.4556	1.4561

Forward Price

- The forward price for a contract is the delivery price that would be applicable to the contract if were negotiated today (i.e., it is the delivery price that would make the contract worth exactly zero)
- The forward price may be different for contracts of different maturities (as shown by the table)

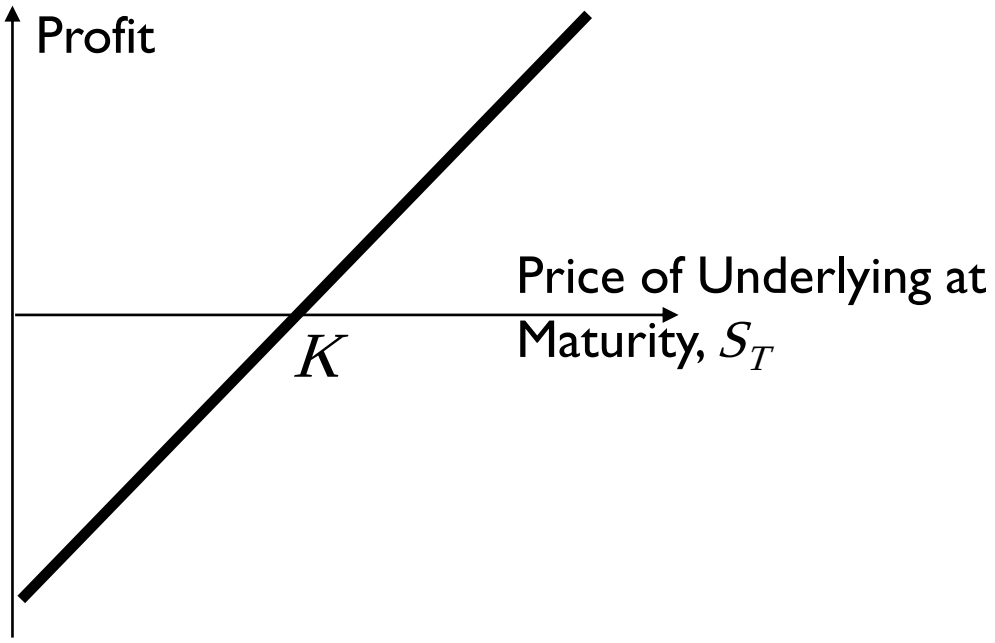
Terminology

- The party that has agreed to buy has what is termed a long position
- The party that has agreed to sell has what is termed a short position

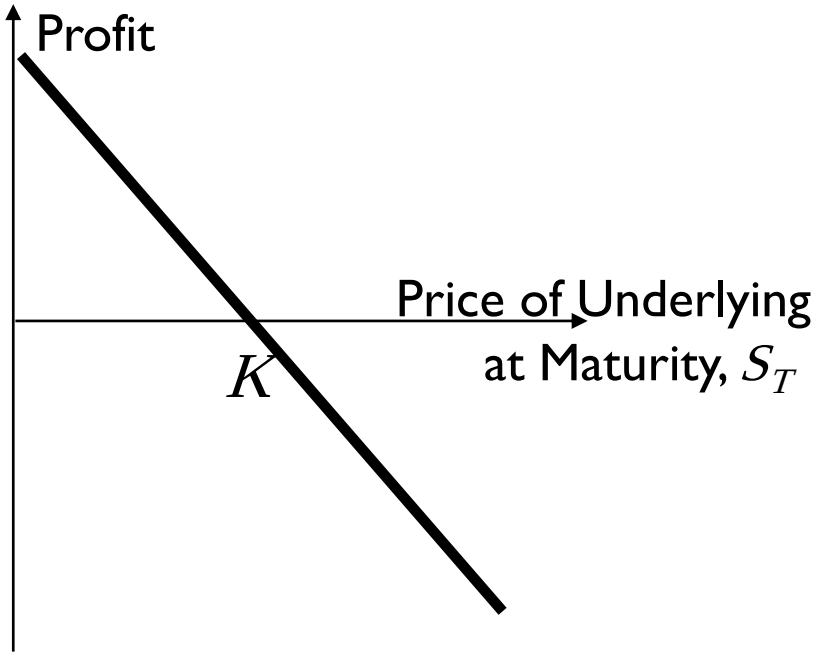
Example (pages 6-7)

- On May 3, 2016, the treasurer of a corporation enters into a long forward contract to buy £1 million in six months at an exchange rate of 1.4561
- This obligates the corporation to pay $1,456,100 for £1 million on November 3, 2016
- What are the possible outcomes?

Profit from a Long Forward Position (K= delivery price=forward price at time contract is entered into)



Profit from a Short Forward Position (K= delivery price=forward price at time contract is entered into)



Futures Contracts (page 8)

- 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

- CME Group (formed when Chicago Mercantile Exchange and Chicago Board of Trade merged)
- InterContinental Exchange
- BM&F (Sao Paulo, Brazil)
- TIFFE (Tokyo)
- and many more (see list at end of book)

Examples of Futures Contracts

Agreement to:

- Buy 100 oz. of gold @ US$1300/oz. in December
- Sell £62,500 @ 1.4500 US$/£ in March
- Sell 1,000 bbl. of oil @ US$50/bbl. in April

1. Gold: An Arbitrage Opportunity?

Suppose that:

- The spot price of gold is US$1,200
- The 1-year forward price of gold is US$1,300
- The 1-year US$ interest rate is 5% per annum

Is there an arbitrage opportunity?

2. Gold: Another Arbitrage Opportunity?

Suppose that:

- The spot price of gold is US$1,200
- The 1-year forward price of gold is US$1,200
- The 1-year US$ interest rate is 5% per annum

Is there an arbitrage opportunity?

The Forward Price of Gold

(ignores the gold lease rate)

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

$$F = S(1+r)^T$$

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

In our examples, $S = 1200$, $T = 1$, and $r = 0.05$ so that

$$F = 1200(1+0.05) = 1{,}260$$

1. Oil: An Arbitrage Opportunity?

Suppose that:

- The spot price of oil is US$50
- The quoted 1-year futures price of oil is US$60
- The 1-year US$ 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$50
- The quoted 1-year futures price of oil is US$40
- The 1-year US$ interest rate is 5% per annum
- The storage costs of oil are 2% per annum

Is there an arbitrage opportunity?

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)

American vs European Options

- An American option can be exercised at any time during its life
- A European option can be exercised only at maturity

Google Call Option Prices from CBOE (May 3, 2016; Stock Price is bid 695.86, offer 696.25); See Table 1.2 page 9

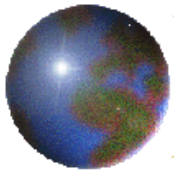
Strike Price	Jun 2016 Bid	Jun 2016 Offer	Sep 2016 Bid	Sep 2016 Offer	Dec 2016 Bid	Dec 2016 Offer
660	43.40	45.10	60.80	62.70	72.70	76.70
680	29.20	30.60	47.70	50.70	60.90	64.70
700	18.30	18.90	37.00	39.20	49.70	52.50
720	9.90	10.50	27.50	29.50	40.10	42.80
740	4.70	5.20	19.80	21.60	31.40	34.40

Google Put Option Prices from CBOE (May 3, 2016; Stock Price is bid 695.86, offer 696.25); See Table 1.3 page 9

Strike Price	Jun 2016 Bid	Jun 2016 Offer	Sep 2016 Bid	Sep 2016 Offer	Dec 2016 Bid	Dec 2016 Offer
660	7.50	8.20	24.20	26.20	35.60	38.10
680	13.30	14.00	31.90	33.80	43.40	46.00
700	21.70	23.00	40.80	42.70	52.40	55.20
720	33.10	34.80	51.10	53.20	62.60	65.20
740	47.70	49.60	63.10	65.20	74.10	76.70

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



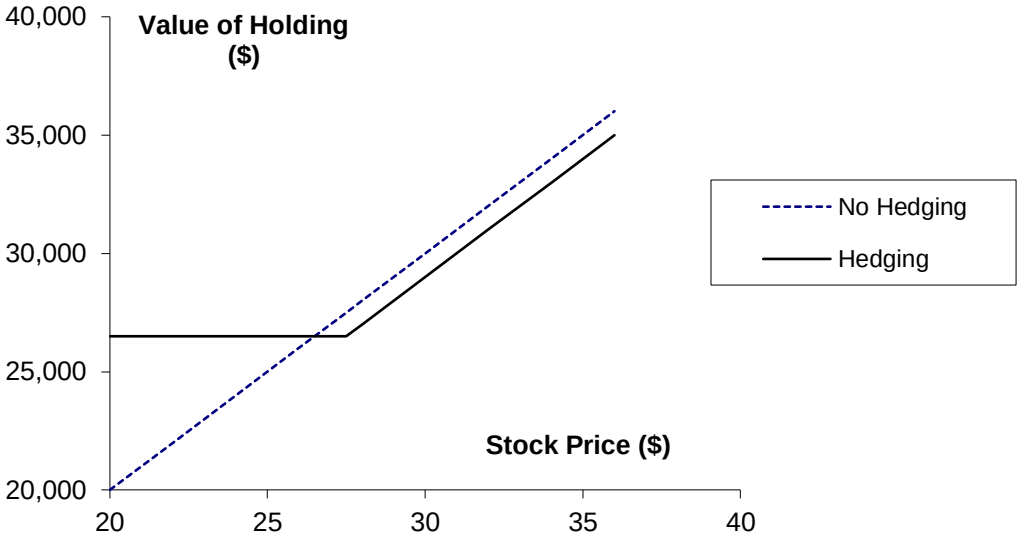
Types of Traders

- Hedgers
- Speculators
- Arbitrageurs

Hedging Examples (pages 11-13)

- A US company will pay £10 million for imports from Britain in 3 months and decides to hedge using a long position in a forward contract
- An investor owns 1,000 Microsoft shares currently worth $28 per share. A two-month put with a strike price of $27.50 costs $1. The investor decides to hedge by buying 10 contracts

Value of Microsoft Shares with and without Hedging (Fig 1.4, page 13)



Speculation Example

- An investor with $2,000 to invest feels that a stock price will increase over the next 2 months. The current stock price is $20 and the price of a 2-month call option with a strike of 22.50 is $1
- What are the alternative strategies?

Arbitrage Example

- A stock price is quoted as £100 in London and $150 in New York
- The current exchange rate is 1.5300
- What is the arbitrage opportunity?

Dangers

- Traders can switch from being hedgers to speculators or from being arbitrageurs to speculators
- It is important to set up controls to ensure that trades are using derivatives in for their intended purpose
- Soc Gen (see Business Snapshot 1.4 on page 18) is an example of what can go wrong

Hedge Funds (see Business Snapshot 1.3, page 12)

- Hedge funds are not subject to the same rules as mutual funds and cannot offer their securities publicly.
- Mutual funds must
  - disclose investment policies,
  - make shares redeemable at any time,
  - limit use of leverage
- Hedge funds are not subject to these constraints.
- Hedge funds use complex trading strategies are big users of derivatives for hedging, speculation and arbitrage

Types of Hedge Funds

- Long/Short Equities
- Convertible Arbitrage
- Distressed Securities
- Emerging Markets
- Global Macro
- Merger Arbitrage