Introduction

Chapter 1
The Nature of Derivatives

A derivative is an instrument whose value depends on the values of other more basic underlying variables.
Examples of Derivatives

• Futures Contracts
• Forward Contracts
• Swaps
• Options
Derivatives Markets

- **Exchange traded**
  - Traditionally exchanges have used the open-outcry system, but increasingly they are switching to electronic trading
  - Contracts are standard there is virtually no credit risk

- **Over-the-counter (OTC)**
  - A computer- and telephone-linked network of dealers at financial institutions, corporations, and fund managers
  - Contracts can be non-standard and there is some small amount of credit risk
Size of OTC and Exchange Markets
(Figure 1.1, Page 3)

Source: Bank for International Settlements. Chart shows total principal amounts for OTC market and value of underlying assets for exchange market.
Ways 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
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 is traded in the over-the-counter market
- Forward contracts are particularly popular on currencies and interest rates
<table>
<thead>
<tr>
<th></th>
<th>Bid</th>
<th>Offer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spot</td>
<td>1.6281</td>
<td>1.6285</td>
</tr>
<tr>
<td>1-month forward</td>
<td>1.6248</td>
<td>1.6253</td>
</tr>
<tr>
<td>3-month forward</td>
<td>1.6187</td>
<td>1.6192</td>
</tr>
<tr>
<td>6-month forward</td>
<td>1.6094</td>
<td>1.6100</td>
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</table>
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
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 (page 4)

- On June 3, 2003 the treasurer of a corporation enters into a long forward contract to buy £1 million in six months at an exchange rate of 1.6100
- This obligates the corporation to pay $1,610,000 for £1 million on December 3, 2003
- What are the possible outcomes?
Profit from a Long Forward Position

\[ \text{Profit} \]

\[ \text{Price of Underlying at Maturity, } S_T \]

\[ K \]
Profit from a Short Forward Position

Profit

Price of Underlying at Maturity, $S_T$
Futures Contracts (page 6)

- 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
- Chicago Mercantile Exchange
- LIFFE (London International Financial Futures Exchange)
- Eurex (Deutsche Börse AG and SWX Swiss Exchange)
- BM&F (Bolsa de Mercadoriasy Futures, Sao Paulo, Brazil)
- TIFFE (Tokyo International Financial Futures Exchange)
- and many more (see list at end of book)
Examples of Futures Contracts

Agreement to:

- buy 100 oz. of gold @ US$400/oz. in December (NYMEX)
- sell £62,500 @ 1.5000 US$/£ in March (CME)
- sell 1,000 bbl. of oil @ US$20/bbl. in April (NYMEX)
1. Gold: An Arbitrage Opportunity?

Suppose that:

- The spot price of gold is US$300
- The 1-year forward price of gold is US$340
- The 1-year US$ 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$300
- The 1-year forward price of gold is US$300
- The 1-year US$ interest rate is 5% per annum

Is there an arbitrage opportunity?
The Forward Price of Gold

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, $S = 300$, $T = 1$, and $r = 0.05$ so that

$$F = 300(1+0.05) = 315$$
1. Oil: An Arbitrage Opportunity?

Suppose that:

- The spot price of oil is US$19
- The quoted 1-year futures price of oil is US$25
- The 1-year US$ 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$19
- The quoted 1-year futures price of oil is US$16
- The 1-year US$ 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
## Intel Option Prices (May 29, 2003; Stock Price=20.83)

See Table 1.2 page 7

<table>
<thead>
<tr>
<th>Strike Price</th>
<th>June Call</th>
<th>July Call</th>
<th>Oct Call</th>
<th>June Put</th>
<th>July Put</th>
<th>Oct Put</th>
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<tbody>
<tr>
<td>20.00</td>
<td>1.25</td>
<td>1.60</td>
<td>2.40</td>
<td>0.45</td>
<td>0.85</td>
<td>1.50</td>
</tr>
<tr>
<td>22.50</td>
<td>0.20</td>
<td>0.45</td>
<td>1.15</td>
<td>1.85</td>
<td>2.20</td>
<td>2.85</td>
</tr>
</tbody>
</table>
Exchanges Trading Options

- Chicago Board Options Exchange
- American Stock Exchange (AMEX)
- Philadelphia Stock Exchange
- Pacific Exchange
- LIFFE
- Eurex
- and many more (see list at end of book)
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

Some of the largest trading losses in derivatives have occurred because individuals who had a mandate to be hedgers or arbitrageurs switched to being speculators (See for example Barings Bank, Business Snapshot 1.2, page 15)
Hedging Examples (pages 10-11)

- 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 11)
Speculation Example

- An investor with $4,000 to invest feels that Amazon.com’s stock price will increase over the next 2 months. The current stock price is $40 and the price of a 2-month call option with a strike of 45 is $2
- What are the alternative strategies?
Arbitrage Example

- A stock price is quoted as £100 in London and $172 in New York
- The current exchange rate is 1.7500
- What is the arbitrage opportunity?
Hedge Funds (see Business Snapshot 1.1, page 9)

- 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