

# CHAPTER 1 Introduction

In recent years futures and options markets have become increasingly important in the world of finance and investments. We have now reached the stage where it is essential for all finance professionals to understand how these markets work, how they can be used, and what determines prices in them. This book addresses these issues.

In this opening chapter we take a first look at futures, forward, and options markets. We examine their history and provide an overview of how they are used by hedgers, by speculators, and by arbitrageurs. Later chapters will give more details and elaborate on many of the topics introduced here.

## 1.1 FUTURES CONTRACTS

A *futures contract* is an agreement to buy or sell an asset at a certain time in the future for a certain price. There are many exchanges throughout the world trading futures contracts. The two largest futures exchanges in the United States are the Chicago Board of Trade ([www.cbot.com](http://www.cbot.com)) and the Chicago Mercantile Exchange ([www.cme.com](http://www.cme.com)). The two largest exchanges in Europe are the London International Financial Futures and Options Exchange ([www.liffe.com](http://www.liffe.com)) and Eurex ([www.eurexchange.com](http://www.eurexchange.com)). Other large exchanges include Bolsa de Mercadorias y Futuros ([www.bmf.com.br](http://www.bmf.com.br)) in São Paulo, the Tokyo International Financial Futures Exchange ([www.tiffe.or.jp](http://www.tiffe.or.jp)), the Singapore International Monetary Exchange ([www.simex.com.sg](http://www.simex.com.sg)), and the Sydney Futures Exchange ([www.sfe.com.au](http://www.sfe.com.au)). For a more complete list, see the table at the end of this book.

We will examine how a futures contract comes into existence by considering the corn futures that trade on the Chicago Board of Trade. In March an investor in New York might call a broker with instructions to buy 5,000 bushels of corn for July delivery. The broker would immediately pass these instructions on to a trader at the Chicago Board of Trade. At about the same time, another investor in Kansas might instruct a broker to sell 5,000 bushels of corn for July delivery. These instructions would also be passed on to a trader at the Chicago Board of Trade. The two traders would meet, they would agree on a price to be paid for the corn in July, and the deal would be done.<sup>1</sup>

<sup>1</sup> As we discuss later, exchanges where traders physically meet are increasingly being replaced by electronic exchanges.

The investor in New York who agreed to buy has what is termed a *long futures position*; the investor in Kansas who agreed to sell has what is termed a *short futures position*. The price agreed to by the two traders is known as the *futures price*. We will suppose the price is 170 cents per bushel. This price, like any other price, is determined by the laws of supply and demand. If at a particular time more traders wish to sell July corn than to buy July corn, the price will go down. New buyers will then enter the market so that a balance between buyers and sellers is maintained. If more traders wish to buy July corn than to sell July corn, the price goes up—for similar reasons.

Issues such as margin requirements, daily settlement procedures, trading practices, commissions, bid-offer spreads, and the role of the exchange clearinghouse will be discussed in Chapter 2. For the time being, we can assume that the end result of the events just described is that the investor in New York has agreed to buy 5,000 bushels of corn for 170 cents per bushel in July and the investor in Kansas has agreed to sell 5,000 bushels of corn for 170 cents per bushel in July. Both sides have entered into a binding contract.

## 1.2 HISTORY OF FUTURES MARKETS

Futures markets can be traced back to the Middle Ages. They were originally developed to meet the needs of farmers and merchants. Consider the position of a farmer in April of a certain year who will harvest a known amount of grain in June. There is uncertainty about the price the farmer will receive. In years of scarcity it might be possible to obtain relatively high prices—particularly if the farmer is not in a hurry to sell. On the other hand, in years of oversupply the grain might have to be disposed of at fire-sale prices. The farmer and the farmer's family are clearly exposed to a great deal of risk.

Consider next a company that has an ongoing requirement for grain. The company is also exposed to price risk. In some years an oversupply situation may create favorable prices; in other years scarcity may cause the prices to be exorbitant. It clearly makes sense for the farmer and the company to get together in April (or even earlier) and agree on a price for the farmer's production of grain in June. In other words, it makes sense for them to negotiate a type of futures contract. The contract provides a way for each side to eliminate the risk it faces because of the uncertain future price of grain.

We might ask what happens to the company's requirements for grain during the rest of the year. Once the harvest season is over, the grain must be stored until the next season. In undertaking this storage, the company does not bear any price risk, but does incur the costs of storage. If the farmer or some other person stores the grain, the company and the storer both face risks associated with the future grain price, and again there is a clear role for futures contracts.

### The Chicago Board of Trade

The Chicago Board of Trade was established in 1848 to bring farmers and merchants together. Initially its main task was to standardize the quantities and qualities of the grains that were traded. Within a few years the first futures-type contract was developed. It was known as a *to-arrive contract*. Speculators soon became interested in the contract and found trading the contract to be an attractive alternative to trading the grain itself. The Chicago Board of Trade now offers futures contracts on many different underlying

assets, including corn, oats, soybeans, soybean meal, soybean oil, wheat, Treasury bonds, and Treasury notes.

### **The Chicago Mercantile Exchange**

In 1874 the Chicago Produce Exchange was established, providing a market for butter, eggs, poultry, and other perishable agricultural products. In 1898 the butter and egg dealers withdrew from the exchange to form the Chicago Butter and Egg Board. In 1919 this was renamed the Chicago Mercantile Exchange (CME) and was reorganized for futures trading. Since then, the exchange has provided a futures market for many commodities, including pork bellies (1961), live cattle (1964), live hogs (1966), and feeder cattle (1971). In 1982 it introduced a futures contract on the Standard & Poor's (S&P) 500 Stock Index.

The Chicago Mercantile Exchange started futures trading in foreign currencies in 1972. The currency futures traded now include the British pound, the Canadian dollar, the Japanese yen, the Swiss franc, the German mark, the Australian dollar, the Mexican peso, the Brazilian real, the South African rand, the New Zealand dollar, the Russian rouble, and the euro. The Chicago Mercantile Exchange also trades a very popular Eurodollar futures contract.

### **Electronic Trading**

Traditionally futures contracts have been traded by what is known as the *open-outcry system*. This involves traders physically meeting on the floor of the exchange and using a complicated set of hand signals to indicate the trades they would like to carry out. This system is still used by the Chicago Board of Trade and the Chicago Mercantile Exchange during regular trading hours. In recent years, other exchanges have replaced the open-outcry system with *electronic trading*. This involves traders entering their required trades at a keyboard and a computer being used to match buyers and sellers. Both the open-outcry system and electronic trading have their advocates, but there seems little doubt that eventually all exchanges will use electronic trading.

## **1.3 THE OVER-THE-COUNTER MARKET**

Not all trading is done on exchanges. What is known as the *over-the-counter market* is an important alternative to exchanges. It is a telephone- and computer-linked network of dealers, who do not physically meet. Trades are done over the phone and are usually between two financial institutions or between a financial institution and one of its corporate clients. Financial institutions often act as market makers for the more commonly traded instruments. This means that they are always prepared to quote both a bid price (a price at which they are prepared to buy) and an offer price (a price at which they are prepared to sell).

Telephone conversations in the over-the-counter market are usually taped. If there is a dispute about what was agreed, the tapes are replayed to resolve the issue. Trades in the over-the-counter market are typically much larger than trades in the exchange-traded market. A key advantage of the over-the-counter market is that the terms of a contract do not have to be those specified by an exchange. Market participants are free to negotiate any mutually attractive deal. A disadvantage is that there is usually some credit risk in an over-the-counter trade (that is, there is a small risk that the contract

**Table 1.1** Spot and forward quotes for the USD/GBP exchange rate, June 19, 2000 (GBP = British pound; USD = U.S. dollar)

|                 | Bid    | Offer  |
|-----------------|--------|--------|
| Spot            | 1.5118 | 1.5122 |
| 1-month forward | 1.5127 | 1.5132 |
| 3-month forward | 1.5144 | 1.5149 |
| 6-month forward | 1.5172 | 1.5178 |

will not be honored). As we will see in the next chapter, exchanges have organized themselves to eliminate virtually all credit risk.

## 1.4 FORWARD CONTRACTS

A forward contract is similar to a futures contracts in that it is an agreement to buy or sell an asset at a certain time in the future for a certain price. But, whereas futures contracts are traded on exchanges, forward contracts trade in the over-the-counter market.

Forward contracts on foreign exchange are very popular. Most large banks have a "forward desk" within their foreign exchange trading room that is devoted to the trading of forward contracts. Table 1.1 provides the quotes on the exchange rate between the British pound (GBP) and the U.S. dollar (USD) that might be made by a large international bank on June 19, 2000. The quote is for the number of USD per GBP. The first quote indicates that the bank is prepared to buy GBP in the spot market (i.e., for virtually immediate delivery) at the rate of \$1.5118 per GBP and sell sterling in the spot market at \$1.5122 per GBP. The second quote indicates that the bank is prepared to buy sterling in one month at \$1.5127 per GBP and sell sterling in one month at \$1.5132 per GBP; the third quote indicates that it is prepared to buy sterling in three months at \$1.5144 per GBP and sell sterling in three months at \$1.5149 per GBP; and so on.

The quotes are for very large transactions. (As anyone who has traveled abroad knows, retail customers face much larger spreads between bid and offer quotes than those in Table 1.1.) After examining the quotes in Table 1.1, a large corporation might agree to sell £100 million in six months for \$151.72 million to the bank as part of its hedging program.

We will give more information on forward markets and the determinants of prices in them in Chapters 2 and 3.

## 1.5 OPTIONS CONTRACTS

There are two basic types of options: calls and puts. A *call option* gives the holder the right to buy an asset by a certain date for a certain price. A *put option* gives the holder the right to sell an asset by a certain date for a certain price. The price in the contract is known as the *exercise price* or the *strike price*; the date in the contract is known as the *expiration date*, the *exercise date*, or the *maturity*. A *European option* can be

**Table 1.2** Prices of options on Cisco, May 8, 2000; stock price =  $62\frac{3}{4}$ 

| Strike price<br>(\$) | Calls           |                 | Puts             |                 |
|----------------------|-----------------|-----------------|------------------|-----------------|
|                      | July            | Oct.            | July             | Oct.            |
| 50                   | $16\frac{7}{8}$ | $18\frac{7}{8}$ | $2\frac{11}{16}$ | $4\frac{5}{8}$  |
| 65                   | 7               | $10\frac{7}{8}$ | $8\frac{1}{4}$   | $10\frac{5}{8}$ |
| 80                   | 2               | 5               | $17\frac{1}{2}$  | $19\frac{1}{2}$ |

exercised only on the maturity date; an *American option* can be exercised at any time during its life.

It should be emphasized that an option gives the holder the right to do something. The holder does not have to exercise this right. This fact distinguishes options from futures (or forward) contracts. The holder of a long futures contract is committed to buying an asset at a certain price at a certain time in the future. By contrast, the holder of a call option has a choice as to whether to buy the asset at a certain price at a certain time in the future. It costs nothing (except for margin requirements, which will be discussed in Chapter 2) to enter into a futures contract. By contrast, an investor must pay an up-front fee or price for an options contract.

The largest exchange in the world for trading stock options is the Chicago Board Options Exchange (CBOE; [www.cboe.com](http://www.cboe.com)). Table 1.2 gives the prices of some of the American options trading on Cisco on May 8, 2000, as they were reported in the *Wall Street Journal* the next day. The option strike prices are \$50, \$65, and \$80. The maturities are July 2000 and October 2000. The July options have a remaining life of about two months and the October options have a remaining life of about five months. Cisco's stock price at the close of trading on May 8, 2000, was  $62\frac{3}{4}$ .<sup>2</sup> Suppose an investor instructs a broker to buy one July call option contract on Cisco with a strike price of \$65. The broker will relay these instructions to a trader at the CBOE. This trader will then find another trader who wants to sell one July call contract on Cisco with a strike price of \$65, and a price will be agreed. We assume that the price is \$7, as indicated in Table 1.2. This is the price for an option to buy one share. In the United States, one stock option contract is a contract to buy or sell 100 shares. Therefore, the investor must arrange for \$700 to be remitted to the exchange through the broker. The exchange will then arrange for this amount to be passed on to the party on the other side of the transaction.

In our example the investor has obtained at a cost of \$700 the right to buy 100 Cisco shares for \$65 each. The party on the other side of the transaction has received \$700 and has agreed to sell 100 Cisco shares for \$65 per share if the investor chooses to exercise the option. If the price of Cisco does not rise above \$65 in the next two months, the option is not exercised, and the investor loses \$700. But if the Cisco share price does well and the option is exercised when it is \$90, the investor is able to buy 100 shares at \$65 per share when they are worth \$90 per share. This leads to a gain of \$2,500, or \$1,800 when the initial cost of the options are taken into account.

Further details about the operation of options markets and how prices such as those

<sup>2</sup> Note that decimalization was introduced for stock prices and stock option prices in the United States in the second half of 2000. See Table 7.3 for decimal quotations.

in Table 1.2 are determined by traders are given in later chapters. At this stage we note that there are four types of participants in options markets:

1. Buyers of calls.
2. Sellers of calls.
3. Buyers of puts.
4. Sellers of puts.

Buyers are referred to as having *long positions*; sellers are referred to as having *short positions*. Selling an option is also known as *writing the option*.

## 1.6 HISTORY OF OPTIONS MARKETS

The first trading in puts and calls began in Europe and in the United States as early as the eighteenth century. In the early years the market got a bad name because of certain corrupt practices. One of these involved brokers being given options on a certain stock as an inducement for them to recommend the stock to their clients.

### **Put and Call Brokers and Dealers Association**

In the early 1900s a group of firms set up the Put and Call Brokers and Dealers Association. The aim of this association was to provide a mechanism for bringing buyers and sellers together. Investors who wanted to buy an option would contact one of the member firms. This firm would attempt to find a seller or writer of the option from either its own clients or those of other member firms. If no seller could be found, the firm would undertake to write the option itself in return for what was deemed to be an appropriate price.

The options market of the Put and Call Brokers and Dealers Association suffered from two deficiencies. First, there was no secondary market. The buyer of an option did not have the right to sell it to another party prior to expiration. Second, there was no mechanism to guarantee that the writer of the option would honor the contract. If the writer did not live up to the agreement when the option was exercised, the buyer had to resort to costly lawsuits.

### **The Formation of Options Exchanges**

In April 1973 the Chicago Board of Trade set up a new exchange, the Chicago Board Options Exchange, specifically for the purpose of trading stock options. Since then options markets have become increasingly popular with investors. The American Stock Exchange ([www.amex.com](http://www.amex.com)) and the Philadelphia Stock Exchange ([www.phlx.com](http://www.phlx.com)) began trading options in 1975. The Pacific Exchange ([www.pacificex.com](http://www.pacificex.com)) did the same in 1976. By the early 1980s the volume of trading had grown so rapidly that the number of shares underlying the option contracts traded each day exceeded the daily volume of shares traded on the New York Stock Exchange.

In the 1980s markets developed in the United States for options in foreign exchange, options on stock indices, and options on futures contracts. The Philadelphia Stock Exchange is the premier exchange for trading foreign exchange options. The Chicago Board Options Exchange trades options on the S&P 100 stock index (OEX), the S&P 500 stock index (SPX), the Nasdaq 100 Index (NDX), and the Dow Jones Industrial

Average (DJX). Most exchanges offering futures contracts now also offer options on these contracts. Thus, the Chicago Board of Trade offers options on corn futures, the Chicago Mercantile Exchange offers options on live cattle futures, and so on. Options exchanges now exist all over the world. (See the table at the end of this book.)

### **The Over-the-Counter Market for Options**

The over-the-counter market for options has grown very rapidly since the early 1980s and is now bigger than the exchange-traded market. One advantage of options traded in the over-the-counter market is that they can be tailored to meet the particular needs of a corporate treasurer or fund manager. For example, a corporate treasurer who wants a European call option to buy 1.6 million British pounds at an exchange rate of 1.5125 will not find exactly the right product trading on an exchange. However, it is likely that many investment banks would be pleased to provide a quote for an over-the-counter contract that meets the treasurer's precise needs.

## **1.7 TYPES OF TRADERS**

Futures, forward, and options markets have been outstandingly successful. The main reason is that they have attracted many different types of traders and have a great deal of liquidity. When an investor wants to take one side of a contract, there is usually no problem in finding someone that is prepared to take the other side.

Three broad categories of traders can be identified: hedgers, speculators, and arbitrageurs. Hedgers use futures, forwards, and options to reduce the risk that they face from potential future movements in a market variable. Speculators use them to bet on the future direction of a market variable. Arbitrageurs take offsetting positions in two or more instruments to lock in a profit. In the next few sections, we consider the activities of each type of trader in more detail.

## **1.8 HEDGERS**

In this section we illustrate how hedgers can reduce their risks with forward contracts and options.

### **An Example of Hedging Using Forward Contracts**

Suppose that it is June 19, 2000, and ImportCo, a company based in the United States, knows that it will have to pay £10 million on September 19, 2000, for goods it has purchased from a British supplier. The USD/GBP exchange rate quotes made by a financial institution are shown in Table 1.1. ImportCo could hedge its foreign exchange risk by buying pounds (GBP) from the financial institution in the three-month forward market at 1.5149. This would have the effect of fixing the price to be paid to the British exporter at \$15,149,000.

Consider next another U.S. company, which we will refer to as ExportCo, that is exporting goods to the United Kingdom and on June 19, 2000, knows that it will receive £30 million three months later. ExportCo can hedge its foreign exchange risk by selling £30 million in the three-month forward market at an exchange rate of 1.5144.

**Table 1.3** Use of forward contracts for hedging

*From the Trader's Desk—June 19, 2000*

ImportCo must pay £10 million on September 19, 2000, for goods purchased from Britain. ExportCo will receive £30 million on September 19, 2000, from a customer in Britain. The quotes in Table 1.1 indicate that three-month sterling can be sold at \$1.5144 per GBP and purchased at \$1.5149 per GBP.

*ImportCo's Hedging Strategy*

Buys £10 million in the three-month forward market to lock in an exchange rate of 1.5149 for the sterling it will pay.

*ExportCo's Hedging Strategy*

Sells £30 million in the three-month forward market to lock in an exchange rate of 1.5144 for the sterling it will receive.

This would have the effect of locking in the U.S. dollars to be realized for the sterling at \$45,432,000.

Table 1.3 summarizes the hedging strategies for ImportCo and ExportCo. Note that if the companies choose not to hedge, they might do better than if they do hedge. Alternatively, they might do worse. Consider ImportCo. If the exchange rate is 1.5000 on September 19 and the company has not hedged, the £10 million that it has to pay will cost \$15,000,000, which is less than \$15,149,000. On the other hand, if the exchange rate is 1.6000, the £10 million will cost \$16,000,000—and the company will wish it had hedged! The position of ExportCo if it does not hedge is the reverse. If the exchange rate in September proves to be less than 1.5144, the company will wish it had hedged; if the rate is greater than 1.5144, it will be pleased it has not done so.

This example illustrates a key aspect of hedging. The cost of, or price received for, the underlying asset is ensured. However, there is no assurance that the outcome with hedging will be better than the outcome without hedging.

### **An Example of Hedging Using Options**

Options can also be used for hedging. Consider an investor who in May 2000 owns 1,000 Microsoft shares. The current share price is \$73 per share. The investor is concerned that the developments in Microsoft's ongoing antitrust case may cause the share price to decline sharply in the next two months and wants protection. The investor could buy 10 July put option contracts on the Chicago Board Options Exchange. This would give the investor the right to sell a total of 1,000 shares for a strike price of \$65. If the quoted option price is \$2.50, each option contract would cost  $100 \times \$2.50 = \$250$ , and the total cost of the hedging strategy would be  $10 \times \$250 = \$2,500$ .

This strategy is summarized in Table 1.4. The strategy costs \$2,500 but guarantees that the shares can be sold for at least \$65 per share during the life of the option. If the market price of Microsoft falls below \$65, the options can be exercised so that \$65,000 is realized for the entire holding. When the cost of the options is taken into account, the amount realized is \$62,500. If the market price stays above \$65, the options are not exercised and expire worthless. However, in this case the value of the holding is always above \$65,000 (or above \$62,500 when the cost of the options is taken into account).

**Table 1.4** Hedging strategy using options

*From the Trader's Desk—May, 2000*

An investor owns 1,000 Microsoft shares and wants protection against a possible decline in the share price over the next two months. The following quotes have been obtained:

Current Microsoft share price: \$73

Microsoft July 65 put: \$2.50

*The Investor's Strategy*

The investor buys 10 put option contracts for a total cost of  $10 \times 100 \times \$2.5 = \$2,500$ .

*The Outcome*

The investor has the right to sell 1,000 shares for at least  $1,000 \times \$65 = \$65,000$  during the next two months.

### A Comparison

A comparison of Tables 1.3 and 1.4 reveals a fundamental difference between the use of forward contracts and options for hedging. Forward contracts are designed to neutralize risk by fixing the price that the hedger will pay or receive for the underlying asset. Option contracts, by contrast, provide insurance. They offer a way for investors to protect themselves against adverse price movements in the future while still allowing them to benefit from favorable price movements. Unlike forwards, options involve the payment of an up-front fee.

## 1.9 SPECULATORS

We now move on to consider how futures and options markets can be used by speculators. Whereas hedgers want to avoid an exposure to adverse movements in the price of an asset, speculators wish to take a position in the market. Either they are betting that the price will go up or they are betting that it will go down.

### An Example of Speculation Using Futures

Consider a U.S. speculator who in February thinks that the British pound will strengthen relative to the U.S. dollar over the next two months and is prepared to back that hunch to the tune of £250,000. One thing the speculator can do is simply purchase £250,000 in the hope that the sterling can be sold later at a profit. The sterling once purchased would be kept in an interest-bearing account. Another possibility is to take a long position in four CME April futures contracts on sterling. (Each futures contract is for the purchase of £62,500.) Table 1.5 summarizes the two alternatives on the assumption that the current exchange rate is 1.6470 and the April futures price is 1.6410. If the exchange rate turns out to be 1.7000 in April, the futures contract alternative enables the speculator to realize a profit of  $(1.7000 - 1.6410) \times 250,000 = \$14,750$ . The cash market alternative leads to an asset being purchased for 1.6470 in February and sold for 1.7000 in April, so that a profit of  $(1.7000 - 1.6470) \times 250,000 = \$13,250$  is made. If the exchange rate falls to 1.6000, the futures contract gives rise to a

**Table 1.5** Speculation using futures*From the Trader's Desk—February*

An investor feels that sterling will strengthen relative to the U.S. dollar over the next two months and would like to take a speculative position. The following quotes have been obtained:

Current exchange rate: 1.6470

April futures price: 1.6410

*Alternative Strategies*

1. Buy £250,000 for \$411,750, deposit the sterling in an interest-earning account for two months and hope that it can be sold for a profit at the end of the two months.
2. Take a long position in four April futures contracts. This commits the investor to purchasing £250,000 for \$410,250 in April. If the exchange rate in April proves to be above 1.6410, the investor will realize a profit.

*Possible Outcomes*

1. Exchange rate is 1.7000 in two months. The investor makes \$13,250 using the first strategy and \$14,750 using the second strategy.
2. Exchange rate is 1.6000 in two months. The investor has a loss of \$11,750 using the first strategy and \$10,250 using the second strategy.

$(1.6410 - 1.6000) \times 250,000 = \$10,250$  loss, whereas the cash market alternative gives rise to a loss of  $(1.6470 - 1.6000) \times 250,000 = \$11,750$ . The alternatives appear to give rise to slightly different profits and losses. But these calculations do not reflect the interest that is earned or paid. It will be shown in Chapter 3 that when the interest earned in sterling and the interest paid in dollars are taken into account, the profit or loss from the two alternatives is the same.

What then is the difference between the two alternatives? The first alternative of buying sterling requires an up-front investment of \$411,750. By contrast, the second alternative requires only a small amount of cash—perhaps \$25,000—to be deposited by the speculator in what is termed a margin account. The futures market allows the speculator to obtain leverage. With a relatively small initial outlay, the investor is able to take a large speculative position.

### An Example of Speculation Using Options

We consider next an example of how a speculator could use options. Suppose that it is October and a speculator considers that Amazon.com is likely to increase in value over the next two months. The stock price is currently \$40, and a two-month call option with a \$45 strike price is currently selling for \$2. Table 1.6 illustrates two possible alternatives assuming that the speculator is willing to invest \$4,000. The first alternative involves the purchase of 100 shares. The second involves the purchase of 2,000 call options (i.e., 20 call option contracts).

Suppose that the speculator's hunch is correct and the price of Amazon.com's shares rises to \$70 by December. The first alternative of buying the stock yields a profit of

$$100 \times (\$70 - \$40) = \$3,000$$

However, the second alternative is far more profitable. A call option on Amazon.com

**Table 1.6** Speculation using options*From the Trader's Desk—October*

A speculator with \$4,000 to invest thinks that the price of Amazon.com will increase in the next two months and has obtained the following quotes:

Current stock price: \$40

Amazon.com December call with a \$45 strike price: \$2

*Alternative Strategies*

1. Buy 100 shares of Amazon.com.
2. Buy 2,000 December call options (or 20 December contracts) on Amazon.com with a \$45 strike price.

The cost of each alternative is \$4,000.

*Possible Outcomes*

1. Amazon.com rises to \$70 by December. The investor makes a profit of \$3,000 using the first strategy and \$46,000 using the second strategy.
2. Amazon.com falls to \$30 by December. The investor loses \$1,000 with the first strategy and \$4,000 with the second strategy.

with a strike price of \$45 gives a payoff of \$25, because it enables something worth \$70 to be bought for \$45. The total payoff from the 2,000 options that are purchased under the second alternative is

$$2,000 \times \$25 = \$50,000$$

Subtracting the original cost of the options yields a net profit of

$$\$50,000 - \$4,000 = \$46,000$$

The options strategy is, therefore, over 15 times more profitable than the strategy of buying the stock.

Options also give rise to a greater potential loss. Suppose the stock price falls to \$30 by December. The first alternative of buying stock yields a loss of

$$100 \times (\$40 - \$30) = \$1,000$$

Because the call options expire without being exercised, the options strategy would lead to a loss of \$4,000—the original amount paid for the options. These results are summarized in Table 1.7.

It is clear from Table 1.7 that options like futures provide a form of leverage. For a given investment, the use of options magnifies the financial consequences. Good outcomes become very good, while bad outcomes become very bad!

**Table 1.7** Comparison of profits (losses) from two alternative strategies for using \$4,000 to speculate on Amazon.com stock in October

| Investor's strategy | December stock price |          |
|---------------------|----------------------|----------|
|                     | \$30                 | \$70     |
| Buy shares          | (\$1,000)            | \$3,000  |
| Buy call options    | (\$4,000)            | \$46,000 |

**Table 1.8** Arbitrage*From the Trader's Desk*

A stock is traded on both the New York Stock Exchange and the London Stock Exchange. The following quotes have been obtained:

New York Stock Exchange: \$172 per share

London Stock Exchange: £100 per share

Value of £1: \$1.7500

*The Trader's Arbitrage Strategy*

1. Buy 100 shares in New York.
2. Sell the shares in London.
3. Convert the sale proceeds from pounds to dollars.

*The Profit*

$$100 \times [(\$1.75 \times 100) - \$172] = \$300$$

**A Comparison**

Futures and options are similar instruments for speculators in that they both provide a way in which a type of leverage can be obtained. However, there is an important difference between the two. In the futures example in Table 1.5, the speculator's potential loss as well as the potential gain is very large. In the options example in Table 1.6, no matter how bad things get, the speculator's loss is limited to the \$4,000 paid for the options.

**1.10 ARBITRAGEURS**

Arbitrageurs are a third important group of participants in futures, forward, and options markets. Arbitrage involves locking in a riskless profit by simultaneously entering into transactions in two or more markets. In later chapters we will see how arbitrage is sometimes possible when the futures price of an asset gets out of line with its cash price. We will also examine how arbitrage can be used in options markets. This section illustrates the concept of arbitrage with a very simple example.

Consider a stock that is traded on both the New York Stock Exchange ([www.nyse.com](http://www.nyse.com)) and the London Stock Exchange ([www.stockex.co.uk](http://www.stockex.co.uk)). Suppose that the stock price is \$172 in New York and £100 in London at a time when the exchange rate is \$1.7500 per pound. An arbitrageur could simultaneously buy 100 shares of the stock in New York and sell them in London to obtain a risk-free profit of

$$100 \times [(\$1.75 \times 100) - \$172]$$

or \$300 in the absence of transactions costs. The strategy is summarized in Table 1.8. Transactions costs would probably eliminate the profit for a small investor. However, a large investment house faces very low transactions costs in both the stock market and the foreign exchange market. It would find the arbitrage opportunity very attractive and would try to take as much advantage of it as possible.

Arbitrage opportunities such as the one just described cannot last for long. As arbitrageurs buy the stock in New York, the forces of supply and demand will cause the dollar price to rise. Similarly, as they sell the stock in London, the sterling price will

be driven down. Very quickly the two prices will become equivalent at the current exchange rate. Indeed, the existence of profit-hungry arbitrageurs makes it unlikely that a major disparity between the sterling price and the dollar price could ever exist in the first place. Generalizing from this example, we can say that the very existence of arbitrageurs means that in practice only very small arbitrage opportunities are observed in the prices that are quoted in most financial markets. In this book most of the arguments concerning futures prices, forward prices, and the values of option contracts will be based on the assumption that there are no arbitrage opportunities.

## 1.11 SUMMARY

In this chapter we have taken a first look at futures, forward, and options markets. Futures and forward contracts are agreements to buy or sell an asset at a certain time in the future for a certain price. Futures contracts are traded on an exchange whereas forward contracts are traded in the over-the-counter market. There are two types of options: calls and puts. A call option gives the holder the right to buy an asset by a certain date for a certain price. A put option gives the holder the right to sell an asset by a certain date for a certain price. Options trade both on exchanges and in the over-the-counter market.

Futures, forwards, and options have been very successful innovations. Three main types of participants in the markets can be identified: hedgers, speculators, and arbitrageurs. Hedgers are in the position of facing risk associated with the price of an asset. They use futures, forward, or option contracts to reduce or eliminate this risk. Speculators wish to bet on future movements in the price of an asset. Futures, forward, and option contracts can give them extra leverage; that is, the contracts can increase both the potential gains and potential losses in a speculative investment. Arbitrageurs are in business to take advantage of a discrepancy between prices in two different markets. If, for example, they see the futures price of an asset getting out of line with the cash price, they will take offsetting positions in the two markets to lock in a profit.

### Quiz (Answers at End of Book)

- 1.1. What is the difference between a long futures position and a short futures position?
- 1.2. Explain carefully the difference between (a) hedging, (b) speculation, and (c) arbitrage.
- 1.3. What is the difference between (a) entering into a long futures contract when the futures price is \$50 and (b) taking a long position in a call option with a strike price of \$50?
- 1.4. An investor enters into a short forward contract to sell £100,000 for \$1.5000 per £. How much does the investor gain or lose if the exchange rate at the end of the contract is (a) 1.4900 and (b) 1.5200?
- 1.5. Suppose that you write a put contract on AOL Time Warner with a strike price of \$40 and an expiration date in three months. The current stock price of AOL Time Warner is \$41. What have you committed yourself to? How much could you gain or lose?
- 1.6. You would like to speculate on a rise in the price of a certain stock. The current stock price is \$29, and a three-month call with a strike price of \$30 costs \$2.90. You have

\$5,800 to invest. Identify two alternative strategies. Briefly outline the advantages and disadvantages of each.

- 1.7. Suppose you own 5,000 shares that are worth \$25 each. How can put options be used to provide you with insurance against a decline in the value of your holding over the next four months?

## Questions and Problems (Answers in Solutions Manual)

- 1.8. A stock when it is first issued provides funds for a company. Is the same true of an exchange-traded stock option? Discuss.
- 1.9. Explain why a futures contract can be used for either speculation or hedging.
- 1.10. A cattle farmer expects to have 120,000 pounds of live cattle to sell in three months. The live-cattle futures contract on the Chicago Mercantile Exchange is for the delivery of 40,000 pounds of cattle. How can the farmer use the contract for hedging? From the farmer's viewpoint, what are the pros and cons of hedging?
- 1.11. It is now July 2001. A mining company has just discovered a small deposit of gold. It will take six months to construct the mine. The gold will then be extracted on a more or less continuous basis for one year. Futures contracts on gold are available on the New York Commodity Exchange. There are delivery months every two months from August 2001 to December 2002. Each contract is for the delivery of 100 ounces. Discuss how the mining company might use futures markets for hedging.
- 1.12. Suppose that a March call option with a strike price of \$50 costs \$2.50 and is held until March. Under what circumstances will the holder of the option make a gain? Under what circumstances will the option be exercised?
- 1.13. Suppose that a June put option with a strike price of \$60 costs \$4 and is held until June. Under what circumstances will the holder of the option make a gain? Under what circumstances will the option be exercised?
- 1.14. An investor writes a September call option with a strike price of \$20. It is now May, the stock price is \$18, and the option price is \$2. Describe the investor's cash flows if the option is held until September and the stock price is \$25 at this time.
- 1.15. An investor writes a December put option with a strike price of \$30. The price of the option is \$4. Under what circumstances does the investor make a gain?
- 1.16. Discuss how foreign currency options can be used for hedging in the situation described in Table 1.3 so that (a) ImportCo is guaranteed that its exchange rate will be less than 1.5300, and (b) ExportCo is guaranteed that its exchange rate will be at least 1.4900.
- 1.17. The Chicago Board of Trade offers a futures contract on long-term Treasury bonds. Characterize the investors likely to use this contract.
- 1.18. An airline executive has argued: "There is no point in our using oil futures. There is just as much chance that the price of oil in the future will be less than the futures price as there is that it will be greater than this price." Discuss the executive's viewpoint.
- 1.19. "Options and futures are zero-sum games." What do you think is meant by this statement?

**Assignment Questions**

- 1.20. The price of gold is currently \$500 per ounce. Forward contracts are available to buy or sell gold at \$700 for delivery in one year. An arbitrageur can borrow money at 10% per annum. What should the arbitrageur do? Assume that the cost of storing gold is zero.
- 1.21. The current price of a stock is \$94, and three-month call options with a strike price of \$95 currently sell for \$4.70. An investor who feels that the price of the stock will increase is trying to decide between buying 100 shares and buying 2,000 call options (20 contracts). Both strategies involve an investment of \$9,400. What advice would you give? How high does the stock price have to rise for the option strategy to be more profitable?
- 1.22. On May 8, 2000, an investor owns 100 Cisco shares. As indicated in Table 1.2 the share price is  $62\frac{3}{4}$  and an October put option with a strike price 50 costs  $4\frac{5}{8}$ . The investor is comparing two alternatives to limit downside risk. The first involves buying one October put option contract with a strike price of 50. The second involves instructing a broker to sell the 100 shares as soon as Cisco's price reaches 50. Discuss the advantages and disadvantages of the two strategies.