CHAPTER 1: INTRODUCTION

A derivative (or derivative security) is a financial instrument whose value depends on the values of other, more basic underlying variables. Derivatives are also known as contingent claims, and these two terms are used interchangeably throughout the book. Very often the variables underlying derivatives are the prices of traded securities. This book has two objectives. The first to explore the properties of those derivatives that are commonly encountered in practice; the second is to provide a theoretical framework within which all derivatives can be valued and hedged.

1.1 Forward Contracts

A forward contract is a particular simple derivative. It is an agreement to buy or sell an asset at a certain future time for a certain price. It is not normally traded on an exchange.

One of the parties to a forward contract assumes a long position and agrees to buy the underlying asset on a certain specified future date for a certain specified price. The other party assumes a short position and agrees to sell the asset on the same date for the same price. The specified price in a forward contract will be referred to as the delivery price. At the time the contract is entered into, the delivery price is chosen so that the value of the forward contract to both parties is zero.

A forward contract is settled at maturity. A key variable determining the value of a forward contract at any time given is the market price of the asset. As already mentioned, a forward contract is worth zero when it is first entered into. Later it can have a positive or a negative value, depending on movements in the price of the asset.

Forward Price

The forward price for a certain contract is defined as the delivery price which would make the contract have zero value. It follows that the forward price and the delivery price are equal at the time the contract is entered into. Generally, the forward price at any given time varies with the maturity of the contract being considered.

Payoffs from Forward Contracts

In general, the payoff from a long position in a forward contract on one unit of an asset is

\[ S_T - K \]

This is because the holder of the contract is obligated to buy an asset worth \( S_T \) for \( K \). The opposite is true for the short side.

1.2 Futures Contracts

Like a forward contract, a futures contract is an agreement between two parties to buy or sell an asset at a certain time in the future for a certain price. Unlike forward contracts, futures contracts are normally traded on an exchange. To make trading possible, the exchange specifies certain standardized features of the contract. As the two
parties to the contract do not necessarily know each other, the exchange also provides a mechanism which gives the two parties a guarantee that the contract will be honored.

One way in which a futures contract is different from a forward contract is that an exact delivery date is usually not specified. The contract is referred to as by its delivery month, and the exchange specifies the period during the month when delivery must be made.

1.3 Options

There are two basic types of options. A call option gives the holder the right to buy the underlying asset by a certain date for a certain price. A put option gives the holder the right to sell the underlying asset by a certain date for a certain price. The price in the contract is known as the exercise price or strike price; the date in the contract is known as the expiration date, or maturity. American options can be exercised at any time up to the expiration date. European options can be exercised only on the expiration date itself.

It should be emphasized that an option gives the holder the right to do something. The holder does not have to exercise the right. This fact distinguishes options from forwards and futures, where the holder is obligated to buy or sell the underlying asset. Note that whereas its cost nothing to enter into a forward or futures contract, there is a cost to entering into an option contract.

Option positions

There are two sides to every option contract. On one side is the investor who has taken the long position. On the other side is the investor who has taken a short position. The writer of an option receives cash up front but has potential liabilities later. His or her profit or loss is the reverse of that for the purchaser of the option.

Payoffs

Four basic option positions are possible:

1. A long position in a call option.
2. A long position in a put option.
3. A short position in a call option.

It's often useful to characterize European option positions in terms of the payoff to the investor at maturity. The initial cost of the option is then not included in the calculation. If \( X \) is the strike price and \( \mathcal{S}_T \) is the final price of the underlying asset, the payoff from a long position in a European call option is

\[
\max (\mathcal{S}_T - K, 0)
\]

This reflects the fact that the option will be exercised if \( \mathcal{S}_T > K \) and will not be exercised otherwise. The payoff to the holder of a short position in the European call option is

\[
- \max (\mathcal{S}_T - K, 0) = \min (X - \mathcal{S}_T, 0)
\]

The payoff to the holder of a long position in a European put option is
\[
\max (X - S_T, 0)
\]

And the payoff from a short position in a European put option is

\[-\max (X - S_T, 0) \text{ or } \min (S_T - K, 0)\]

1.5 Types of Traders

Traders of derivatives can be categorized as hedgers, speculators, or arbitrageurs. Hedgers are interested in reducing a risk that they already face. The purpose of hedging is to make the outcome more certain. It does not necessarily improve the outcome.

Whereas hedgers want to eliminate an exposure to movements in the price of an asset, speculators want to take a position in the market. Either they are betting that a price will go up or they are betting that it will go down. There is an important difference between speculating using forward markets and speculating by buying the underlying asset in the spot market. Buying a certain amount of the underlying asset in the spot market requires an initial cash payment equal to the total value of what is bought. Entering into a forward contract on the same amount of the asset requires no initial cash payment. Speculating using forward markets therefore provides an investor with a much higher level of leverage than speculating using spot markets.

Arbitrageurs are a third important group of participants in derivatives markets. Arbitrage involves locking in a riskless profit by entering simultaneously into transactions in two or more markets. 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.