

## 十六 Asset Valuation: Derivative Investments

### 1.A: Introduction

a: Define derivative instrument, arbitrage opportunity, forward contract, futures contract, option (both a put and a call), option on futures, and swap.

A **financial derivative** is a financial instrument whose payoffs depend on another financial instrument or asset. For example, an option on a share of stock depends on the value of the underlying price of the share. This book discusses four types of derivatives: forwards, futures, options, and swaps.

An **arbitrage opportunity** is the chance to make a riskless profit with no investment. In arbitrage, you observe two identical assets with different prices.

A **forward contract** is a contract negotiated in the present that gives the contract holder both the right and full legal obligation to conduct a transaction at a specific future time involving a specific quantity and type of asset at a predetermined price.

A **futures contract** is a forward contract that has been highly standardized and closely specified. As with a forward contract, a futures contract calls for the exchange of some good at a future date for cash, with the payment for the good to occur at the future delivery date.

An **options contract** gives its owner the right, but not the legal obligation, to conduct a transaction involving an underlying asset at a predetermined future date and at a predetermined price (called the exercise or strike price). Options, however, only give the long position the right to decide whether or not the trade will eventually take place.

A **swap** is an agreement between two or more parties to exchange sets of cash flows over a period in the future. The parties that agree to the swap are known as counterparties. The cash flows that the counterparties make are generally tied to the value of debt instruments or the value of foreign currencies. Therefore, the two basic kinds of swaps are interest rate swaps and currency swaps.

b: Discuss the no-arbitrage principle.

Since any observed pricing errors will be instantaneously corrected by the first person to observe them, any quoted price must be free of all known errors. This is the basis behind the text's **no-arbitrage principle**, which states that any rational price for a financial instrument must exclude arbitrage opportunities. The no-arbitrage opportunity assumption is the basic requirement for rational prices in the financial markets. This means that markets and prices are efficient. That is, all relevant information is impounded in the asset's price.

c: Distinguish between a futures contract and a forward contract.

- Forwards are private contracts and do not trade on an organized exchange. Futures contracts trade on organized exchanges.
- Forwards are unique contracts satisfying the needs of the parties involved. Futures contracts are highly standardized. A futures contract specifies the quantity, quality, delivery date, and delivery mechanism.

- Forwards have default risk. The seller may not deliver and the buyer may not accept delivery. With futures contracts, performance is guaranteed by the exchange's clearinghouse.
- Forwards require no cash transactions until the delivery date. Futures contracts require that traders post margin money to trade. Margin is good faith money that supports the trader's promise to fulfill their obligation.
- Forward contracts are usually not regulated. The government regulates futures markets.

d: Distinguish between an option buyer and an option writer.

The owner of a **call option** has the right to purchase the underlying good at a specific price for a specified time period, while the owner of a **put option** has the right to sell the underlying good at a specific price for a specified time period. To acquire these rights, owners of options must buy them by paying a price called the **premium** to the seller of the option.

For every owner of an option, there must be a seller. The seller of the option is called an **option writer**. You will notice with options that there are four possible positions: the buyer of a call option, the writer (seller) of a call option, the buyer of a put option, and the writer (seller) of a put option. In these agreements, the rights lie with the owner of the option. The buyer pays the premium and receives the right to buy or sell the underlying good on specific terms. The writer or seller of the option receives payment and promises to sell or purchase the underlying good on specific terms at the discretion of the option owner.

e: Explain how financial derivatives contributed to market completeness.

A complete market is one in which any and all identifiable payoffs can be obtained by trading the securities available in the market. This is a desirable characteristic of a financial market because it helps market participants maximize their welfare by enabling them to fulfill their trading needs.

f: Explain the major applications of financial derivatives.

**Speculation.** The derivative markets allow traders to take a wide range of high risk positions. This adds to the completeness of markets.

**Risk management.** Derivatives provide a tool for enabling individuals and firms to manage their risk by allowing them to hedge their positions in the markets. Through hedging, firms can choose to shift their risk to market speculators.

**The concept of arbitrage.** Derivatives make it easier to arbitrage away mispricing in the markets.

**Trading efficiency.** Traders may find trading financial derivatives more attractive than trading the underlying security. Trading market index futures may be cheaper and easier than taking a position in a diversified portfolio, and interest rate futures may be a good substitute for a

portfolio of Treasury securities. Derivative markets are frequently more liquid and offer lower transactions costs than the actual securities markets.

### 1.B: Futures Markets

a: Distinguish between a speculator and a hedger.

**Traders** can be described as **speculators** (meaning they accept the market's risk in pursuit of profits) or **hedgers** (meaning they trade futures to reduce some pre-existing risk exposure). Short hedgers would be firms who own the asset (like wheat) and want to reduce their risk by selling the asset now (short the wheat) in the futures market. Long hedgers would be firms who are short the asset (like a baker who has promised to deliver bread) and want to reduce their risk by buying the asset now (going long wheat) in the futures market.

b: Distinguish between volume and open interest.

The **open interest** is the number of contracts that are currently in existence. An open interest of 100 would imply that there are 100 short positions in existence and 100 long position in existence. Activity in the futures markets is measured by **trading volume**. Trading volume can represent either a new contract being created between a buyer and seller or an existing contract being traded by one of the existing traders to a new trader.

c: Discuss how the standardization of futures contract promotes market liquidity.

A major difference between forwards and futures is that futures contracts have standardized contract terms. Futures contracts specify the quality and quantity of good that can be delivered, the delivery time, and the manner of delivery. The exchange also sets the minimum price fluctuation (which is called the tick size). For example, the basic price movement, or tick, for a 5,000-bushel grain contract is a quarter of a point or \$12.50 per contract. Contracts also have a daily price limit, which sets the maximum price movement allowed in a single day. For example, wheat cannot move more than 20¢ from its close the preceding day. The maximum price limits expand during periods of high volatility and are not in effect during the delivery month. The exchange also sets the trading times for each contract.

d: Discuss the role of the clearinghouse in trading futures contracts.

Each exchange has a clearinghouse. The clearinghouse guarantees that traders in the futures market will honor their obligations. The clearinghouse does this by splitting each trade once it is made and acting as the opposite side of each position. The clearinghouse acts as the buyer to every seller and the seller to every buyer. By doing this, the clearinghouse allows either side of the trade to reverse positions later without having to contact the other side of the initial trade. This allows traders to enter the market knowing that they will be able to reverse their position any time that they want. Traders are also freed from having to worry about the other side of the trade defaulting, since the other side of their trade is now the clearinghouse. In the history of U.S. futures trading, the clearinghouse has never defaulted.

e: Define initial margin, maintenance margin, variation margin, daily settlement (marking to market) and margin call.

To safeguard the clearinghouse, the exchange requires traders to post margin and settle their accounts on a daily basis. Before trading, the trader must deposit funds (called margin) with their broker. The purpose of margin is to ensure that traders will perform their contractual obligations.

There are three types of margin. The first deposit is called the **initial margin**. Initial margin must be posted before any trading takes place. Initial margin is fairly low and equals about one day's maximum price fluctuation. The margin requirement is low because at the end of every day there is a **daily settlement** process called marking-the-account-to-market. In **marking-to-market** any losses for the day are removed from the trader's account and any gains are added to the trader's account. If the margin balance in the trader's account falls below a certain level (called the **maintenance margin**), the trader will get a margin call and have to deposit more money into the account to bring the account back up to the initial margin level.

f: Calculate the price at which a trader will receive a maintenance margin call.

Bob buys one contract of corn at \$2.00 per bushel (1 contract = 5,000 bushels). The **initial margin** was \$1,000. The next day the price of corn falls by 3¢ a bushel. So, Bob has just lost \$150. At the end of the day, the **daily settlement** process **marks** Bob's margin account **to market** by taking \$150 out of his account leaving a balance of \$850. Now assume the **maintenance margin** level is 75%. If Bob's margin balance falls to or below \$750, Bob will get a **margin call** and have to bring his account back up to the initial \$1,000 level. For example, during the next day corn again falls 3¢ per bushel. Bob's margin account balance now falls to \$700, and Bob gets a margin call to deposit \$300 in **variation margin**. The deposit of \$300 will bring his account back up to the initial level of \$1,000.

g: Describe the three ways to close a futures position.

There are three ways to get out of a futures position once you take it. You can satisfy the contract by delivering the goods. This is called **delivery**. Depending on the wording of the contract, delivery can be made by physically delivering the goods to the designated location or by making a cash settlement of any gains or losses.

You can make a **reverse or offsetting trade** in the futures market. Since the other side of your position is held by the clearinghouse, if you make an exact opposite trade (maturity, quantity, and good) to your current position, the clearinghouse will net your positions out leaving you with a zero balance. This is how most futures positions are settled. A position may also be settled through an **exchange for physicals (EFP)**. Here, you find a trader with an opposite position to your own and deliver the goods and settle up between yourselves off the floor of the exchange (called an ex-pit transaction). This is the one exception

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