FRM Part 1

Book 3 - Financial Markets and Products

Chapter 4

INTRODUCTION - Options, Futures, and Other Derivatives

Learning Objectives

After completing this reading you should be able to:

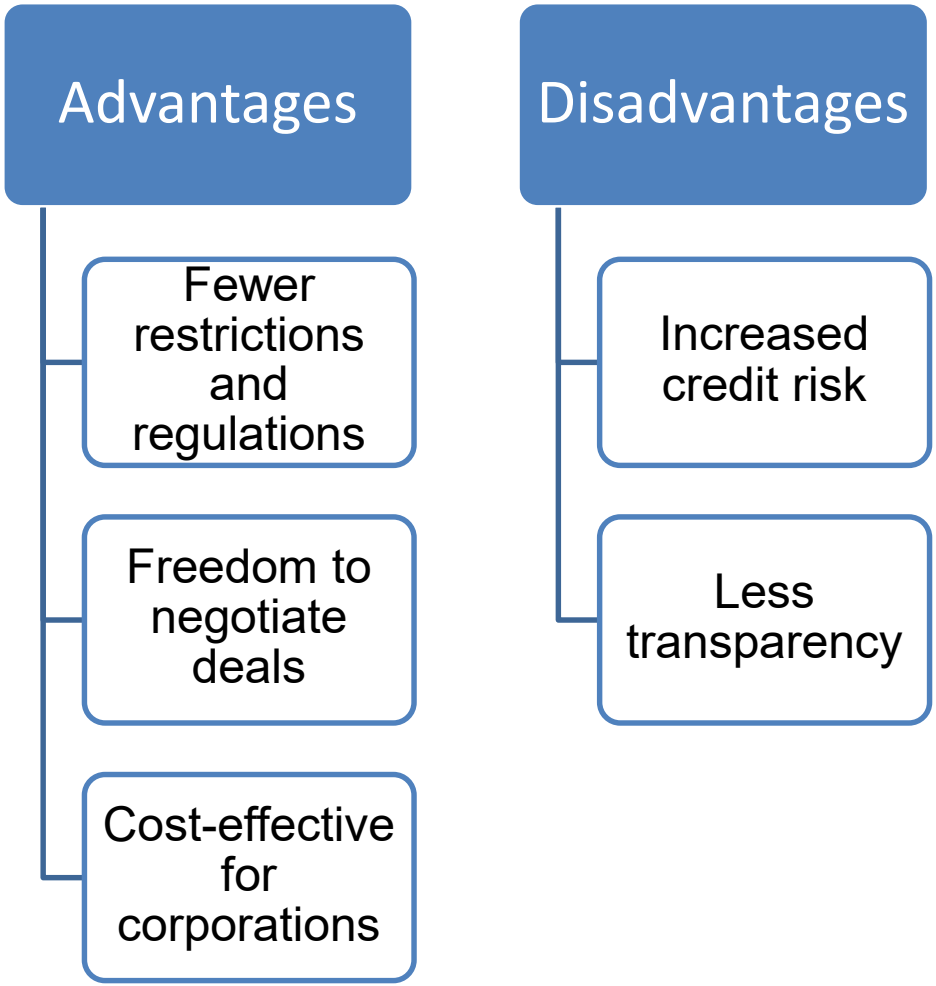
- ✓ Describe the **over-the-counter market**, distinguish it from trading on an **exchange**, and evaluate its **advantages** and **disadvantages**.
- ✓ Differentiate between **options**, **forwards**, and **futures contracts**.
- ✓ Identify and calculate **option** and **forward contract payoffs**.
- ✓ Calculate and compare the payoffs from **hedging strategies** involving forward contracts and options.
- ✓ Calculate and compare the payoffs from **speculative strategies** involving futures and options.
- ✓ Calculate an **arbitrage payoff** and describe how **arbitrage opportunities** are temporary.
- ✓ Describe some of the **risks** that can arise from the use of derivatives.
- ✓ Differentiate among the broad **categories of traders**: hedgers, speculators, and arbitrageurs.

Over-the-counter Trading vs. Exchange Trading

Over-the counter market:

- **Decentralized** trading platform, without a central physical location, where market participants use a host of communication channels to trade with one another **without a formal set of regulations**.
  - The communication channels commonly used include telephone, email, and computers.
- In an OTC market, it's possible for two participants to exchange products/securities **privately without others being aware of the terms**, including the price.
- OTC markets are much **less transparent** than exchange trading.
- Stocks traded in an OTC market could belong to a **small company** that's yet to satisfy the conditions for listing on the exchange.
- The OTC market is also popular for **large trades**.

Over-the-counter Trading vs. Exchange Trading



Options, Futures, and Forwards

An options contract:

- **An agreement between two parties** to transact on an underlying security at a **predetermined price** called the strike price prior to some date called the **expiration date**.
- The option gives the holder a **right but not the obligation** to buy/sell the underlying at an agreed upon date at the strike price.
- A call option gives the holder the right but not the obligation to buy the underlying asset at the strike price prior to the expiration date.
  - The call option holder is betting that the **price** of the underlying **will rise**.
- A put option, on the other hand, gives the holder the right but not the obligation to sell the underlying asset at the strike price prior to the expiration date.
  - The put option holder is betting that the **price** of the underlying **will decrease**.

Options, Futures, and Forwards

A forward contract:

- A **non-standardized contract** between two parties that specifies the **price** and the **quantity** of an asset to be **delivered in the future**.
  - They are **traded in the OTC market**.
- One party takes the long position and agrees to buy the underlying asset at a specified price on the specified date, while the other party takes the short position and agrees to sell the asset on that same date at that same price.

A futures contract:

- A **standardized**, legally-binding agreement between two parties that specifies the price at which to trade a given asset (commodity or financial instrument) at a **specified future date**.
  - Futures contracts can be **traded on exchanges** (CME, CBOE, etc.)

Options, Futures, and Forwards

- Futures contracts **differ from forwards** in several other aspects:
  - **Clearinghouse** - The clearinghouse is an **interposed party** between the buyer and the seller which ensures the performance of the contract. In essence, futures contracts have **no credit risk**.
  - **Marking to market** - Since the clearinghouse must monitor the credit risk between the buyer and the seller, it performs **daily marking to market.** This is the settlement of the gains and losses on the contract on a daily basis. It avoids the accumulation of large losses over time.
  - **Margins** - Daily settlements may not provide a buffer strong enough to avoid future losses. For this reason, each party is required to **post collateral that can be seized in the event of default**. The **initial margin** must be posted when initiating the contract. If the equity in the account falls below the **maintenance margin**, the relevant party is required to provide additional funds to cover the initial margin.

Example >>

Options, Futures, and Forwards

Example

- An investor enters into a long position in a coffee futures contract (KCN20) at **$520.50** per bag.
  - Each futures contract controls **100 bags**.
  - The **initial margin is $5,200** and the **maintenance margin is $4,700**.
  - At the close of trading on the first day, the futures price **drops to $512**.
- What is the investor **required to do** at the end of the first trading day?

Solution

- Loss on position = ($520.50 – $512) × 100 = $850
- New margin = $5,200 – $ 850 = $4,350
- Because this is below the **maintenance margin of $4,700**, an additional payment of $850 must be made **to bring back the equity to the initial margin of $5,200**.

Calculating Option and Forward Contract Payoffs

Call Option Payoff:

- To the buyer

$$C_T = max(0, ST - X)$$

- Where:
  - $\mathbf{C_T}$ = call option payoff
  - $\mathbf{S_T}$ = stock price at maturity
  - **X** = strike price
  - To the seller, payoff = $-\mathbf{C_T}$
  - The price paid for the call, $\mathbf{C_0}$ is also called the call premium.
  - **Profit to call option buyer = $\mathbf{C_T - C_0}$**
  - **Profit to the option seller = $\mathbf{C_0 - C_T}$**

Calculating Option and Forward Contract Payoffs

Put Option Payoff:

- To the buyer

$$P_T = max(0, X - ST)$$

- Where:
  - $\mathbf{P_T}$ = put option payoff
  - $\mathbf{S_T}$ = stock price at maturity
  - **X** = strike price
  - To the seller, payoff = $-\mathbf{P_T}$
  - The price paid for the call, $\mathbf{P_0}$ is also called the call premium.
  - **Profit to call option buyer = $\mathbf{P_T - P_0}$**
  - **Profit to the option seller = $\mathbf{P_0 - P_T}$**

Calculating Option and Forward Contract Payoffs

Forward Contract Payoff:

- The payoff to the long position is given by:

$$payoff = ST - K$$

- Where:
  - **S_T** = spot price at maturity
  - **K** = delivery price
  - The payoff to the short position = $K - S_T$

How Hedging Works

- The use derivatives like futures and options to **reduce** or **eliminate financial exposure**.
  - An investor with a **long position** in an asset can hedge the exposure by entering into a **short futures contract** or by **buying a put option**.
  - An investor with a **short position** in an asset can hedge the exposure by entering into a **long futures contract** or by **buying a call option**.
- A forward contract helps the hedger to **lock in the price** of the underlying security.
  - Forward contracts **do not need any investment at onset**.
- The hedger gives up any movement that may have had **positive** or **negative results** if they left the position **unhedged**.

Example >>

How Hedging Works

Example

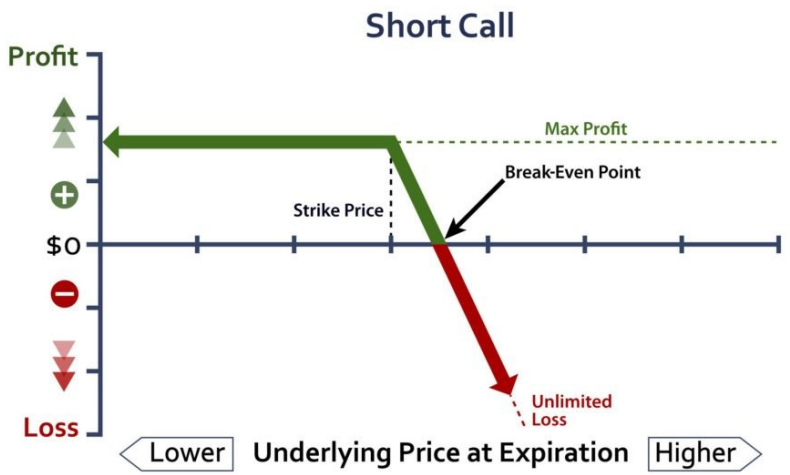
- Suppose a U.S. based company is scheduled to receive **£10 million in six months**.
- The current exchange rate stands at **1.32 $/£** .
- The management is worried that the **pound might depreciate** against the dollar, so it decides to hedge the exchange risk with a forward contract at 1.3 $ / £.
- With the forward, the company will be **guaranteed to receive $13 million**.
  - Suppose the company **does not hedge the position** and the exchange rate in six months turns out to be 1.25 $/£, then the company would **receive $12,500,000**.
  - Suppose further that the company **does hedge the position** at 1.3 $/£ and the rate turns out to be 1.35 $ / £. In this case, the company will **still receive $13 million** but will be forced to **give up the extra $500,000** it would have received if it didn't hedge the position.

Payoffs from Speculative Strategies Involving Futures Contracts

- Speculative trading refers trading **without the intention of obtaining the underlying commodity**.
  - Speculators basically **make bets on the market**, unlike hedgers whose priority is to eliminate exposures.
- Speculators are motivated by the **leverage** that comes with **futures contracts** in which **no initial investment is required**.
  - All that's needed is the **initial margin** required by the clearinghouse/exchange.
  - The margin is no more than a **percentage of the notional value** of the underlying.
- The gains or losses associated with futures can be **quite large**, and **payoffs are symmetrical**.
- Speculators trade in futures with the intention of reselling these contracts before maturity.

Payoffs from Speculative Strategies Involving Options Contracts

- For options, speculators only need to part with the option's price at the onset, which is often just a **few dollars for 100 shares worth of the underlying**.
- Options have **asymmetrical payoffs**. Going long on options can bring in significant gains, but losses are limited to the option's price paid.
  - Note that it's the exact opposite for being **short a call option**, where the **payoff is limited** and the **losses are unlimited**.



Arbitrage Payoffs

- Arbitrage opportunities exist when **prices of similar assets** are set at **different levels**.
- An **arbitrageur** attempts to make a **risk-free profit** by buying the asset in the cheaper market and simultaneously selling it in the overpriced market.

Example

- Suppose ABC stock is trading at **$200 on exchange A** and **$198 on exchange B**.
- If you **buy** one ABC stock **on exchange B** and simultaneously **sell** it on **exchange A**, you can make a **risk-free profit of $2** without any outlay of cash.
- However, arbitrage opportunities are normally **short-lived** because of the nature of **efficient markets**.

Risks in Derivative Trading

Market risk

- There are no guarantees the **market price will move in favor** of the derivative trader.

Counterparty risk

- The risk that the buyer, seller, or dealer will **default on the contract**.
- Particularly prevalent in **OTC markets**.

Liquidity risk

- The **bid-ask spreads** could be so large as to represent a substantial cost.

Operational risk

- The risk that a trader with instructions to use derivatives as a hedging tool will be tempted to take **speculative positions**, or hit the wrong button!

Exam Tips

Bid-ask spread

- The **bid price** is the "quoted bid," or the **highest price**, which a dealer is willing to pay to **purchase** a security.
- The **offer price** is the price at which the security is **offered for sale**, also known as the "asking price."
- The **bid-ask spread** represents the **difference** between the offer price and the bid price.

European vs. American options

- All **European options** can only be exercised **at maturity**.
- **American options**, on the other hand, may be exercised **any time** between issue date and expiration.

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