

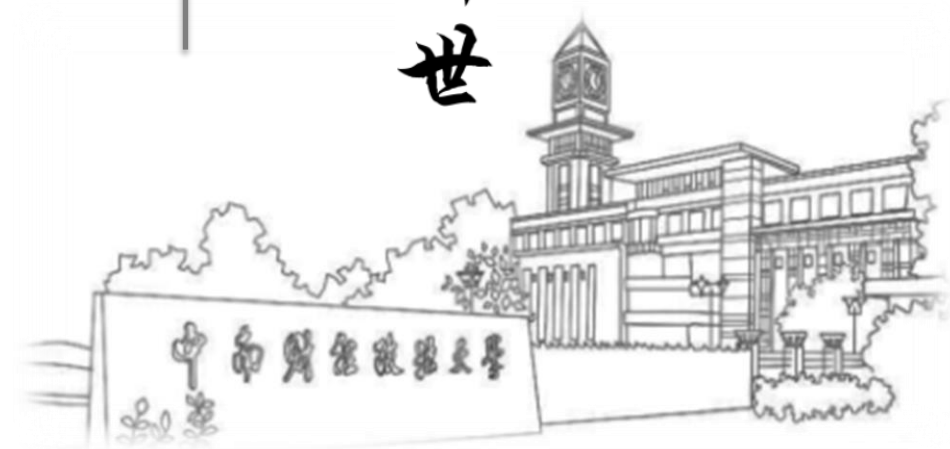


中南财经政法大学

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# Financial Markets

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## Chapter 24: Hedging with Financial Derivatives

# Chapter Preview

- We examine how markets for derivatives work and how the products are used by financial managers to reduce risk. Topics include:
  - Hedging
  - Forward Markets
  - Financial Futures Markets
  - Stock Index Futures
  - Options
  - Interest-Rate Swaps
  - Credit Derivatives

# Hedging

- Definitions
  - **long position:** an asset which is purchased or owned
  - **short position:** an asset which must be delivered/sold at a future date
- Hedging involves engaging in a financial transaction to offset an existing position to reduce or eliminate risk.

# Forward Markets

- **Forward contracts** are agreements by two parties to engage in a financial transaction at a future point in time.
- The contract usually includes:
  - The exact assets to be delivered by one party, including the location of delivery
  - Amount of the assets to be delivered
  - The price (interest rate) paid for the assets by the other party
  - The date when the assets and cash will be exchanged

# Forward Markets

- An Example of an Interest-rate Contract
  - First National Bank agrees to deliver \$5 million in face value of 6% Treasury bonds maturing in 2027
  - Rock Solid Insurance Company agrees to pay \$5 million for the bonds
  - FNB and Rock Solid agree to complete the transaction one year from today at the FNB headquarters in town.

# Forward Markets

- **Long Position**

- Agree to accept delivery of securities at future date subject to terms of forward contract.
- Hedges by locking in future interest rate of funds coming in future, avoiding rate decreases.

- **Short Position**

- Agree to deliver securities at future date subject to terms of forward contract
- Hedges by reducing price risk from increases in interest rates if holding bonds.

# Hedging— Long or Short?

- **Quiz:** Suppose you work for a business whose expects to receive \$15 million from a client next year. You are worried that interest rates are going to fall next year as the US economy slows.
- How would you hedge against the interest rate risk your company faces?



# Hedging— Long or Short?

**A:** You take a long position in bonds to offset your existing long position in cash—engage in a Forward Contract to buy \$15 million in bonds at a fixed price.

# Forward Markets

- **Pros**

1. Flexible

- **Cons**

1. Lack of liquidity: hard to find a counter-party and thin or non-existent secondary market
2. Subject to default risk—requires information to screen good from bad risk
3. Adverse selection and moral hazard problems.

# Financial Futures Markets

**Financial futures contracts** are highly standardized forward contracts traded on organized exchanges subject to specific rules.

## Traded on Exchanges

- Developed by Chicago Board of Trade in 1975 to solve liquidity and default problems of forward contracts. Global competition Regulated by CFTC.

# Financial Futures Markets

Financial Futures Contracts Specify:

1. Type of security to be traded
2. Delivery Location
3. Amount to be Delivered
4. Date
5. Price

# Financial Futures Markets

- In line with the terminology used for forward contracts, parties who have bought a futures contract and thereby agreed to buy of the bonds are said to have taken a **long position**, and parties who have sold a futures contract and thereby agreed to sell the bonds have taken a **short position**.
- **Micro hedge**: hedge the interest-rate risk for a specific asset it is holding.
- **Macro hedge**: hedge for the institution's entire portfolio.

# Financial Futures Markets

- Delivery?
  1. If the position remains open until the delivery date, then shorts must deliver and longs must accept delivery of underlying asset.
  2. But before the delivery date, positions can be closed by taking the opposite position.

Delivery occurs in about 3% of T-bond and T-note contracts.

- Profit or Loss—note that when the price of the futures contract rises, investors with a long position gain, and short positions lose.

# Financial Futures Markets

- Trading
  - Your broker contacts floor trader who executes purchase or sale of futures contract
  - Trades are effectively with the exchange's clearinghouse acting as a counterparty in each trade. There must be a short position for each long position.
  - All trades require a Margin Deposit.
    - Initial Margin is set by the exchange for each contract type
    - End of trading day settlement price on contract is determined
    - Each open account is marked to market. If  $P \uparrow$ , long position profits and short position loses.

# Financial Futures Markets

- At the expiration date of a futures contract, the price of the contract converge to the price of the underlying asset to be delivered.
- The elimination of riskless profit opportunities in the futures market is referred to as **arbitrage**, and it guarantees that the price of a future contract at expiration equals the price of the underlying asset to be delivered.



# Futures VS. Forward Contract

	Futures	Forward
Delivery quantity and date are standardized	Yes	No
Tradable at any time until the delivery date	Yes	No
Many different securities can be delivered	Yes	No
Buyer and Seller transact directly	No, they contract with the clearinghouse associated with the futures exchange	Yes
The underlying asset will be delivered eventually	No, most future contracts do not result in delivery of the underlying asset on the expiration date	Yes

# Success of Financial Futures Contract

1. FFC are more liquid: standardized contracts that can be traded
2. Delivery of range of securities reduces the chance of corner.
3. Mark to market daily, margin requirement : avoids default risk
4. Don't have to deliver: cash netting of positions

# Widely Traded Financial Futures Contracts

**TABLE 24.1** Widely Traded Financial Futures Contracts

Type of Contract	Contract Size	Exchange*	Open Interest (May 2016)
<b>Interest-Rate Contracts</b>			
Treasury bonds	\$100,000	CBOT	564,537
Treasury notes	\$100,000	CBOT	2,629,971
Five-year Treasury notes	\$100,000	CBOT	2,556,335
Two-year Treasury notes	\$200,000	CBOT	1,007,329
Fed funds	\$5 million	CBOT	1,008,414
Eurodollar	\$1 million	CME	10,816,515
<b>Stock Index Contracts</b>			
Standard & Poor's 500 Index	\$250 × index	CME	83,115
<b>Currency Contracts</b>			
Yen	¥12,500,000	CME	156,605
Euro	€125,000	CME	356,777
Canadian dollar	C\$100,000	CME	126,537
British pound	£62,500	CME	243,778
Swiss franc	SF 125,000	CME	57,178
Mexican peso	MXN 500,000	CME	143,577

\*Exchange abbreviations: CBOT, Chicago Board of Trade; CME, Chicago Mercantile Exchange.

Source: CME Group: [www.cmegroup.com/market-data/volume-open-interest/index.html](http://www.cmegroup.com/market-data/volume-open-interest/index.html).

# Hedging FX Risk

- Example: A manufacturer expects to be paid 10 million euros in two months for the sale of equipment in Europe. Currently, the spot exchange rate is 1, that is one euro buys one dollar:  $\$/\text{€} = 1$ , and the manufacturer would like to lock-in that exchange rate.

# Hedging FX Risk

- The manufacturer can use the FX futures market to accomplish this:
  1. The manufacturer sells 10 million euros of futures contracts. Assuming that 1 contract is for € 125,000 in euros, the manufacturer takes as **short** position in **80 contracts**.  
$$\# \text{ contracts} = VA/VC = € 10\text{m} / € 125,000$$
  2. The exchange will require the manufacturer to deposit cash into a margin account. For example, the exchange may require \$1,000 per contract, or \$80,000.

# Hedging FX Risk

3. As the exchange rate (and the futures price) fluctuates during the two months, the value of the margin account will fluctuate. If the value in the margin account falls too low, additional funds may be required. This is how the market is **marked to market**. If additional funds are not deposited when required, the position will be closed by the exchange.

# Hedging FX Risk

4. Assume that actual exchange rate is  $\$/\text{€} = .96$  at the end of the two months. The manufacturer receives the 10 million euros and exchanges them in the **spot market** for \$9,600,000.
5. The manufacturer also closes the margin account, which has \$480,000 in it—\$400,000 for the changes in exchange rates ( $= 80 \times 125,000 \times .04$ ) plus the original \$80,000 required by the exchange (assumes no margin calls).
6. In the end, the manufacturer has the \$10,000,000 desired from the sale. Hence, the manufacturer is protected from any foreign exchange movements.

# Stock Index Futures

- Financial institution managers, particularly those that manage mutual funds, pension funds, and insurance companies, also need to assess their **stock market risk**, the risk that occurs due to fluctuations in equity market prices.
- One instrument to hedge this risk is **stock index futures**.



# Stock Index Futures

- **Stock index futures** are a contract to buy or sell a particular stock index. Contracts exist for most major indexes, including the S&P 500, Dow Jones Industrials, Russell 2000, etc.
  - Deliver dates are December, March, June and September.
  - Futures Contract price is quoted the same way the index is, i.e. in index points.
  - Value of Futures Contract (S&P) is \$250 multiplied by the index value.

# Hedging with Stock Index Futures

- Example: Rock Solid has a stock portfolio worth \$100 million, which tracks closely with the S&P 500. The portfolio manager fears that a decline is coming and wants to completely hedge the value of the portfolio over the next year.

# Hedging with Stock Index Futures

- Assume the current price of the March S&P 500 futures is 800.
- The value of each contract is  $\$250 \times \text{price of the contract}$ 
  - currently  $\$250 \times 800 = \$200,000$  per contract
  - Need to sell \$100 million of index futures
  - # of contracts = Value of Asset / Value of Contract
    - =  $\$100 \text{ million} / (\$250 \times P_{FC})$
    - =  $\$100 \text{ million} / (\$250 \times \$800)$
    - = 500 contracts

# Hedging with Stock Index Futures

**Spot:** S&P ↓ 10%, index falls from 800 to 720

\$10m loss on portfolio

**Futures:** profit of  $500 \times 250 \times (800 - 720) = \$10\text{m}$

You shorted the S&P index, so you sold 500 contracts at  $\$250 \times 800$  for each

But you can close your position by buying at  $\$250 \times 720$  per contract

# Hedging with Stock Index Futures

- Note that the portfolio is protected from **downside** risk, the risk that the value in the portfolio will fall. However, to accomplish this, the manager has also eliminated any **upside** potential.
- Now we will examine a hedging strategy that protects against downside risk, but does not sacrifice the upside. Of course, this comes at a price! Here comes the Options!

# Options

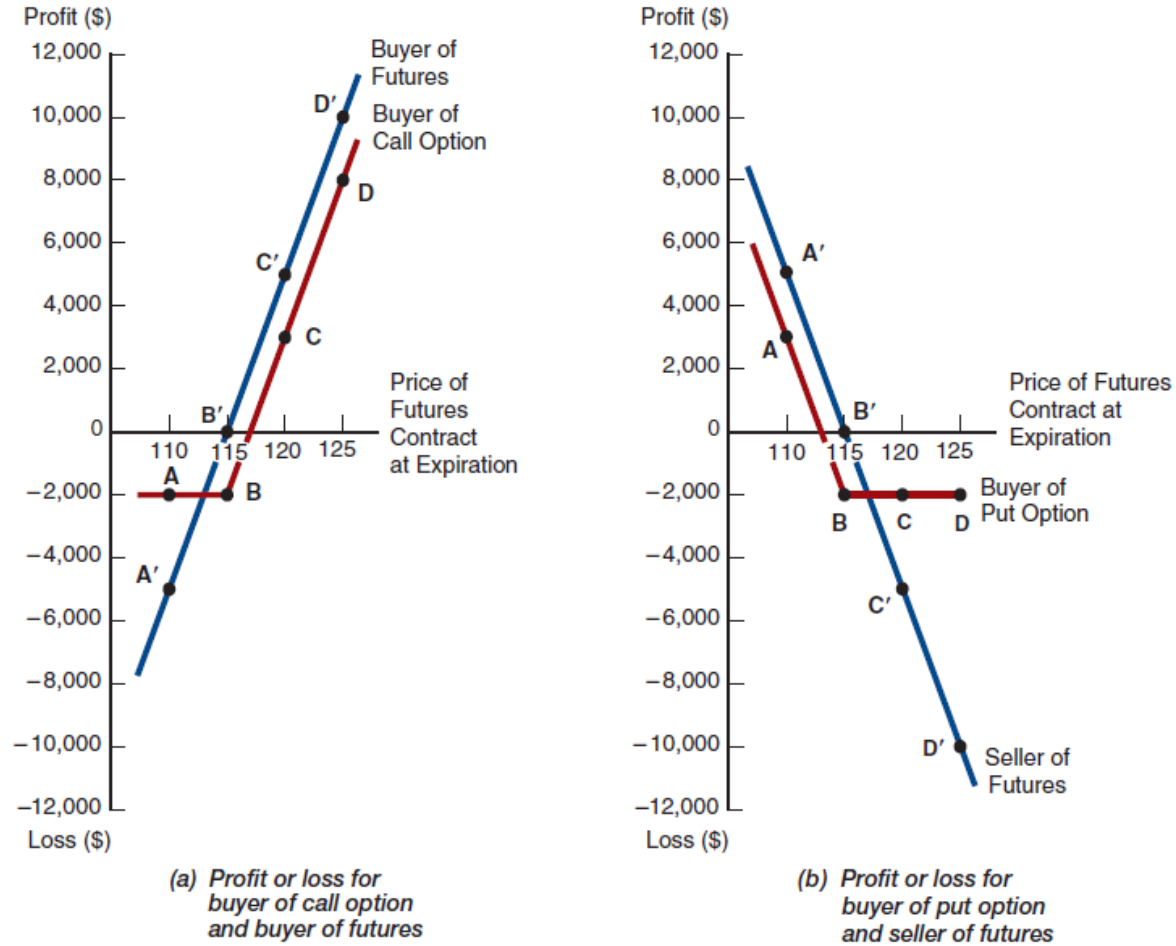
- **Options** are contracts that give the purchasers the option, or **right**, to buy or sell the underlying financial instrument at a specified prices (aka, **exercise price** or **strike price**), within a specific period of time.
- The price of purchasing an option is called **premium**.
- **American options** can be exercised at any time up to the expiration date of the contract.
- **European options** can be exercised only on the expiration date.

# Options

- A **call option** is a contract that gives the owner the right to **buy** a financial instrument at the exercise price within a specific period of time.
- A **put option** is a contract that gives the owner the right to **sell** a financial instrument at the exercise price within a specific period of time.

# Option VS. Futures

## (1) Different Profits and Losses on Option and Futures



**FIGURE 24.1** Profits and Losses on Options Versus Futures Contracts

The futures contract is the \$100,000 June Treasury bond contract, and the option contracts are written on this futures contract with an exercise price of 115. Panel (a) shows the profits and losses for the buyer of the call option and the buyer of the futures contract, and panel (b) shows the profits and losses for the buyer of the put option and the seller of the futures contract.



# Option VS. Futures

(2) The initial investment on the contracts differs.

When a futures contract is purchased, the investor must put up a fixed amount, the margin requirement, in a margin account. But when an option contract is purchased, the initial investment is the premium that must be paid for the contract.

(3) Futures contract requires money to change hands daily when the contract is marked to market, whereas the option contract requires money to change hands only when it is exercised.

# Factors Affecting the Price of Option Premiums

- 1) The higher the strike price, everything else being equal, the lower the premium on call (buy) options and the higher the premium on put (sell) options.
- 2) The greater the term to expiration, everything else being equal, the higher the premiums for both call and put options.
- 3) The greater the volatility of prices of the underlying financial instrument, everything else being equal, the higher the premiums for both call and put options.

# Swaps

- **Swaps** are financial contracts that obligate each party to the contract to exchange (swap) a set of payments it owns for another set of payments owned by the other party.
- Swaps are of two basic kinds:
  - (1) **Currency swaps** involve the exchange of a set of payments in one currency for a set of payments in another currency.
  - (2) **Interest-rate swaps** involve the exchange of one set of interest payments for another set of interest payments, all denominated in the same currency.

# Interest-rate Swaps

- Advantages of Interest-rate Swaps

- (1) Save large transaction costs for financial institutions

- (2) Swaps can be written for very long horizons

- Disadvantages of Interest-rate Swaps (same as forward contracts)

- (1) Lack of liquidity

- (2) Subject to the default risk.

Note: it is important to note that the default risk of swaps is not the same as the default risk on the full amount of the notional principal because the notional principal is never exchanged

# Credit Derivatives

**Credit derivatives** offer payoffs linked to previously issued securities, but ones that bear credit risk.

## (1) Credit Options

- (a) One type of credit options entitles the purchaser to receive profits that are tied either to the price of an underlying security or to an interest rate.
- (b) Another type of credit options ties profits to changes in an interest rate, such as a credit spread.

# Credit Derivatives

## **(3) Credit Swaps**

In a credit swap, risky payments on loans are swapped for each other.

## **(4) Credit Default Swaps**

It functions as insurance. One party pays a fixed payment on a regular basis, in return for a contingent payment that is triggered by a credit event, such as the bankruptcy of a particular firm or the downgrading of the firm's credit rating.

## **(5) Credit-Linked Notes**

It makes periodic coupon (interest) payments and a final payment of the face value of the bond at maturity. If a key financial variable specified in the note changes, however, the issuer of the note has the right (option) to lower the payments on the note.

# Chapter Summary

- **Hedging:** the basic idea of entering into an offsetting contract to reduce or eliminate some type of risk was presented.
- **Forward Markets:** the basic idea of contracts in this highly specialized market, as well as a simple example of eliminating risk was presented.
- **Financial Futures Markets:** these exchange traded markets were presented, as well as their advantages over forward contracts.

# Chapter Summary (cont.)

- **Stock Index Futures:** the specific application of stock index futures was presented, exploring their ability to reduce or eliminate risk for equity portfolios.
- **Options:** gives the purchaser the right to buy (call option) or sell (put option) a security at the exercise (strike) price within a specific period of time.
- **Interest-rate Swaps:** exchange of one set of interest payments for another set of interest payments.
- **Credit Derivatives:** a new type of derivatives that offer payoffs on previously issued securities that have credit risk.



# Acknowledgment

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