

Chapter

14

Futures Contracts

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Forward Contract Basics, II.

- Important: The price at which the trade will occur is also determined when the agreement is made.
 - This price is known as the **forward price**.
- One party faces **default risk**, because the other party might have an incentive to default on the contract.
- To cancel the contract, both parties must agree.
 - One side might have to make a dollar payment to the other to get the other side to agree to cancel the contract.

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Futures Contract Basics, I.

- A **Futures contract** is an agreement made **today** between a buyer and a seller who are **obligated** to complete a transaction at a date in the future.
- The buyer and the seller **do not** know each other.
 - The "negotiation" occurs in the fast-paced frenzy of a futures pit.
- The terms of a futures contract are **standardized**.
 - What to trade; Where to trade; When to trade; How much to trade; what quality of good to trade—all standardized under the terms of the futures contract.

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Futures Contract Basics, II.

- The price at which the trade will occur is determined "in the pit" or, increasingly, "in the electronic market."
 - This price is known as the **futures price**.
- No one faces default risk, even if the other party has an incentive to default on the contract.
 - The **Futures Exchange** where the contract is traded guarantees each trade—no default is possible.
- To cancel the contract, an offsetting trade is made, either "in the pit" or in the electronic market.
 - The trader of a futures contract may experience a gain or a loss.

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Organized Futures Exchanges

- Established in 1848, the Chicago Board of Trade (CBOT) was the first organized futures exchange in the United States.
- Other Major Exchanges include:
 - New York Mercantile Exchange (1872)
 - Chicago Mercantile Exchange (1874)
- Early in their history, these exchanges only traded contracts in storable agricultural commodities (i.e., soybeans, corn, wheat).
- Agricultural futures contracts are still important to organized futures exchanges.
- During 2007, there were several important events for organized futures exchanges.
 - The IntercontinentalExchange (ICE) purchased the New York Board of Trade (NYBOT)
 - The Chicago Mercantile Exchange (CME) and the Chicago Board of Trade (CBOT) merged and are now The CME Group, Inc.

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Financial Futures

- Financial futures are also important to organized futures exchanges.
- Some important milestones:
 - Currency futures trading, 1972.
 - Gold futures trading, 1974.
 - Actually, on December 31, 1974.
 - The **very day** that ownership of gold by U.S. citizens was legalized.
 - U.S. Treasury bill futures, 1976.
 - U.S. Treasury bond futures, 1977.
 - Eurodollar futures, 1981.
 - Stock Index futures, 1982.
- Today, financial futures are so successful that they constitute the bulk of all futures trading.

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Futures Contracts Basics

- In general, futures contracts must stipulate at least the following five terms:
 - ① The identity of the underlying commodity or financial instrument.
 - ② The futures contract size.
 - ③ The futures maturity date, also called the expiration date.
 - ④ The delivery or settlement procedure.
 - ⑤ The futures price.

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Why Futures?

- A futures contract represents a **zero-sum game** between a buyer and a seller.
 - Gains realized by the buyer are offset by losses realized by the seller (and vice-versa).
 - The futures exchanges keep track of the gains and losses every day.
- Futures contracts are used for hedging and speculation.
 - Hedging and speculating are complementary activities.
 - Hedgers **shift** price risk to speculators.
 - Speculators **absorb** price risk.

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Speculating with Futures, Long

- Buying a futures contract (today) is often referred to as "going long," or establishing a **long position**.
- Recall: Each futures contract has an expiration date.
 - Every day before expiration, a new futures price is established.
 - If this new price is **higher** than the previous day's price, the holder of a **long** futures contract position **profits** from this futures price **increase**.
 - If this new price is **lower** than the previous day's price, the holder of a **long** futures contract position **loses** from this futures price **decrease**.

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Example I: Speculating in Gold Futures

- You believe the price of gold will go up. So,
 - You go **long** 100 futures contracts that expire in 3 months.
 - The futures price today is **\$800** per ounce.
 - There are 100 ounces of gold in each futures contract.
- Your "position value" is: $\$800 \times 100 \times 100 = \$8,000,000$
- Suppose your belief is correct, and the price of gold is **\$820** when the futures contract expires.
- Your "position value" is now: $\$820 \times 100 \times 100 = \$8,200,000$
Your "long" speculation has resulted in a gain of \$200,000

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Speculating with Futures, Short

- Selling a futures contract (today) is often called "going short," or establishing a **short position**.
- Recall: Each futures contract has an expiration date.
 - Every day before expiration, a new futures price is established.
 - If this new price is **higher** than the previous day's price, the holder of a **short** futures contract position **loses** from this futures price **increase**.
 - If this new price is **lower** than the previous day's price, the holder of a **short** futures contract position **profits** from this futures price **decrease**.

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Example II: Speculating in Gold Futures

- You believe the price of gold will go down. So,
 - You go **short** 100 futures contracts that expire in 3 months.
 - The futures price today is **\$800** per ounce.
 - There are 100 ounces of gold in each futures contract.
- Your "position value" is: $\$800 \times 100 \times 100 = \$8,000,000$
- Suppose your belief is correct, and the price of gold is **\$770** when the futures contract expires.
- Your "position value" is now: $\$770 \times 100 \times 100 = \$7,700,000$
Your "short" speculation has resulted in a gain of \$300,000

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Hedging with Futures, Short Hedge

- A company has a large inventory that will be sold at a future date.
- So, the company will suffer losses if the value of the inventory falls.
- Suppose the company wants to protect the value of their inventory.
 - Selling futures contracts today offsets potential declines in the value of the inventory.
 - The act of selling futures contracts to protect from falling prices is called **short hedging**.

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Example: Short Hedging with Futures Contracts

- Suppose Starbucks has an inventory of about **950,000** pounds of coffee, valued at \$1.47 per pound.
- Starbucks fears that the price of coffee will fall in the short run, and wants to protect the value of its inventory.
- How best to do this? You know the following:
 - There is a coffee futures contract at the New York Board of Trade.
 - Each contract is for 37,500 pounds of coffee.
- 25 futures contracts covers **937,500** pounds.
- 26 futures contracts covers **975,000** pounds.

Real world decision!

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Example: Short Hedging with Futures Contracts, Cont.

- Starbucks decides to sell 25 near-term futures contracts.
- Over the next month, the price of coffee falls. Starbucks sells its inventory for \$1.41 per pound.
- How did this short hedge perform?
- That is, how much protection did selling futures contracts provide to Starbucks?

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Hedging with Futures, Long Hedge

- A company needs to buy a commodity at a future date.
- The company will suffer "losses" if the price of the commodity increases before then. (That is, they paid more than they could have)
- Suppose the company wants to "fix" the price that they will pay for the commodity.
 - Buying futures contracts today offsets potential increases in the price of the commodity.
 - The act of buying futures contracts to protect from rising prices is called **long hedging**.

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Example: Long Hedging with Futures Contracts

- Suppose Nestles plans to purchase 750 metric tons of cocoa next month.
- Nestles fears that the price of cocoa (which is \$3,400 per ton) will increase before they acquire the cocoa.
- Nestles wants to "set" the price it will pay for cocoa.
- How best to do this? You know the following:
 - There is a cocoa futures contract at the New York Board of Trade.
 - Each contract is for 10 metric tons of cocoa.
 - Cocoa futures price with three months to expiration is \$3,440 per ton.
 - Buying futures contracts provides inventory "acquisition" price protection.
- 75 futures contracts covers 750 metric tons.

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Example: Long Hedging with Futures Contracts, Cont.

- Nestles decides to buy 75 near-term futures contracts.
- Over the next month, the price of cocoa increases, and Nestles pays \$3,490 per ton for its cocoa.
- The futures price also increases, to \$3,525. (There are two months left on the futures contract)

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The Long Hedge Performance

This is a reference price to show the difference in what will be paid.

Date	Nestles Cocoa Price	Nestles Inventory Acquisition	Near-Term Cocoa Futures Price	Value of 75 Cocoa Futures Contracts
Now	\$3,400	\$2,550,000	\$3,440	\$2,580,000
1-Month From now	\$3,490	\$2,617,500	\$3,525	\$2,643,750
Gain (Loss)	\$90	\$67,500	\$85	\$63,750

- The hedge was not perfect. But, the long hedge "threw-off" cash (\$63,750) when Nestles needed some extra cash to offset the increase in the cost of their cocoa inventory acquisition (\$67,500).

What would have happened if cocoa prices fell by \$85 instead?

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Futures Trading Accounts

- A futures exchange, like a stock exchange, allows only exchange members to trade on the exchange.
- Exchange members may be firms or individuals trading for their own accounts, or they may be brokerage firms handling trades for customers.

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Important Aspects of Futures Trading Accounts

- The important aspects about futures trading accounts:
 - Margin is required - *initial margin* as well as *maintenance margin*.
 - The contract values are *marked to market* on a daily basis, and a *margin call* will be issued if necessary.
 - A futures position can be closed out at any time. This is done by entering a *reverse trade*.
 - In the hedging examples, Starbucks and Nestles entered reverse trades at the time they adjusted inventories.
 - In those examples, the futures contracts had two months left before expiration.

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Futures Trading Accounts, Cont.

- Initial margin** (which is a "good faith" deposit) is required when a futures position is first established.
- Initial margin** levels:
 - Depend on the price volatility of the underlying asset
 - Can differ by type of trader
- When the price of the underlying asset changes, the futures exchange adds or subtracts money from trading accounts (this is called **marking to market**).
 - When the balance in the trading account gets "too low," it violates **maintenance margin** levels, and a **margin call** is issued.
 - A **margin call** is simply a stern request by the broker that more money be deposited into the trading account.

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Example: Margin and Marking to Market

- Molly opens a trading account with J and M Brokerage.
 - Molly believes gold prices will increase.
 - She will take a long position in gold futures.
 - Molly knows that there are 100 ounces of gold in a gold futures contract.
- Her broker requires an initial margin of \$1,000 per contract, and requires a maintenance margin of \$750 per contract.
- Suppose Molly deposits \$1,000 into her trading account.

Note: A reputable brokerage firm would actually require more, perhaps as much as \$10,000.

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Molly's Trading Account for a Long Position in One Gold Futures Contract

- The futures exchange keeps a daily record that **marks** all trading accounts **to market**.

Day	Deposits	Closing Futures Price	Equity Value of Account	Maint. Margin Level	Diff.	Action
0	\$1,000		\$1,000	\$750	+\$250	Initial Margin Deposit
1		\$800	\$1,000	\$750	+\$250	Molly buys at close
2		\$798	\$800	\$750	+\$50	
3		\$794	\$400	\$750	-\$350	Margin Call for \$600
4	\$600	\$794	\$1,000	\$750	+\$250	

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Cash Prices

- The **Cash price (or spot price)** of a commodity or financial instrument is the price for immediate delivery.
- The **Cash market (or spot market)** is the market where commodities or financial instruments are traded for immediate delivery.
- In reality for some commodities, "immediate" delivery can be 2 or 3 days later.

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Cash-Futures Arbitrage

- Earning risk-free profits from an unusual difference between cash and futures prices is called **cash-futures arbitrage**.
 - In a competitive market, cash-futures arbitrage has very slim profit margins.
- Cash prices and futures prices are seldom equal.
- The difference between the cash price and the futures price for a commodity is known as **basis**.

$$\text{basis} = \text{cash price} - \text{futures price}$$

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Cash-Futures Arbitrage, Cont.

- For commodities with storage costs, the cash price is usually less than the futures price, i.e. $\text{basis} < 0$. This is referred to as a **carrying-charge market**.
- Sometimes, the cash price is greater than the futures price, i.e. $\text{basis} > 0$. This is referred to as an **inverted market**.
- Basis is kept at an economically appropriate level by arbitrage.

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Spot-Futures Parity

- The relationship between spot prices and futures prices that must hold to prevent arbitrage opportunities is known as the **spot-futures parity** condition.
- The equation for the spot-futures parity relationship is:

$$F_T = S(1+r)^T$$

- In the equation, F is the futures price, S is the spot price, r is the risk-free rate per period, and T is the number of periods before the futures contract expires.

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Spot Futures Parity with Dividends

- Spot futures parity is particularly important for stock index futures—and stocks pay dividends.
- If D represents a dividend paid at or near the end of the futures contract's life, the spot-futures parity formula is:

$$F_T = S(1+r)^T - D$$

- If there is dividend yield ($d = D/S$), the spot-futures parity formula is:

$$F_T = S(1+r-d)^T$$

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Stock Index Futures

- There are a number of futures contracts on stock market indexes. Important ones include:
 - The S&P 500
 - The Dow Jones Industrial Average
- Because of the difficulty of actual delivery, stock index futures are usually **cash settled**.
 - That is, when the futures contract expires, there is no delivery of shares of stock.
 - Instead, the positions are "marked-to-market" for the last time, and the contract no longer exists.

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Single Stock Futures

- **OneChicago** began trading single stock futures in November 2002.
- **OneChicago** is a joint venture of the Chicago Board Options Exchange (CBOE), Chicago Mercantile Exchange, Inc. (CME), and the Chicago Board of Trade (CBOT).
- Single Stock Futures contracts are listed on 80 stocks.
 - The underlying asset for single stock futures is 100 shares of common stock.
 - Unlike stock indexes, shares are delivered at futures expiration.
- In addition, futures contracts on about 14 industry sectors are also listed (i.e., Aerospace, Semiconductors, Software, etc.)
 - Each "basket" contains 5 stocks.
 - At expiration, the futures are cash settled.

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Index Arbitrage

- **Index arbitrage** refers to trading stock index futures and underlying stocks to exploit deviations from spot futures parity.
- Index arbitrage is often implemented as a **program trading strategy**.
 - Program trading accounts for about 15% of total trading volume on the NYSE.
 - About 20% of all program trading involves stock-index arbitrage.

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Cross Hedging

- **Cross-hedging** refers to hedging a particular spot position with futures contracts on a **related, but not identical**, commodity or financial instrument.
- For example, you decide to protect your stock portfolio from a fall in value by selling some S&P 500 stock index futures contracts.
- This is a "cross-hedge" if changes in your portfolio value do not move in tandem with changes in the value of the S&P 500 index.

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Hedging Stock Portfolios with Stock Index Futures

- Suppose you want to "hedge" a portfolio, i.e., protect its value against changes in the underlying market.
- In this case, your desired beta, β_D , is zero.
- Suppose the beta of a portfolio, β_P , is calculated using the S&P 500 Index as the benchmark portfolio.
 - We need to know the dollar value of the portfolio to be hedged, V_P .
 - We need the dollar value of one S&P 500 futures contract, V_F (which is $250 \times$ S&P 500 index futures price)
- The formula:
$$\text{Number of contracts} = (\beta_D - \beta_P) \times \frac{V_P}{V_F}$$

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Example: Hedging a Stock Portfolio with Stock Index Futures

- You want to protect the value of a \$185,000,000 portfolio over the near term (so, you will "short-hedge").
 - The beta of this portfolio is 1.25.
 - The desired beta is zero.
 - The S&P futures contract with 3-months to expiration has a price of 1,480.
- How many futures contracts do you need to sell?

$$\text{Number of contracts} = (\beta_D - \beta_P) \times \frac{V_P}{V_F}$$

$$625 = (0 - 1.25) \times \frac{\$185,000,000}{250 \times 1,480}$$

S&P 500 Multiplier: \rightarrow

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Another Portfolio to Cross-Hedge

- To protect a bond portfolio against changing interest rates, we may **cross-hedge** using futures contracts on U.S. Treasury notes.
- It is called a "cross-hedge" if the value of the bond portfolio held does not move in tandem with the value of U.S. Treasury notes.
- A short hedge will protect your bond portfolio against the risk of a general rise in interest rates during the life of the futures contracts.
 - Bond prices fall when interest rates rise.
 - Selling bond futures throws off cash when bond prices fall.

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Hedging Bond Portfolios with T-note Futures

- There is a formula for calculating the number of T-note futures contracts needed to hedge a bond portfolio.
- Information needed for the formula:
 - Duration of the bond portfolio, D_B
 - Value of the bond portfolio, V_B
 - Duration of the futures contract, D_F
 - Value of a single futures contract, V_F
- The formula is: **Number of contracts needed** = $\frac{D_B \times V_B}{D_F \times V_F}$

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Handy Estimate for the Duration of an Interest Rate Futures Contract

- Rule of Thumb Estimate: The duration of an interest rate futures contract, D_F , is equal to:
 - The duration of the underlying instrument, D_U , plus
 - The time remaining until contract maturity, M_F .
- That is:

$$D_F = D_U + M_F$$

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Example: Hedging a Bond Portfolio with T-note Futures

- You want to protect the value of a \$100,000,000 bond portfolio over the near term (so, you will "short-hedge").
 - The duration of this bond portfolio is 8.
 - Suppose the duration of the underlying T-note is 6.5, and the futures contract has 0.5 years to expiration.
 - Also suppose the T-note futures price is 110 (which is 110% of the \$100,000 par value.)
- How many futures contracts do you need to sell?

$$\text{Number of contracts needed} = \frac{D_B \times V_B}{D_F \times V_F}$$

$$1,039 \approx \frac{8 \times \$100,000,000}{(6.5 + 0.5) \times (1.10 \times \$100,000)}$$

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Futures Contract Delivery Options

- The *cheapest-to-deliver option* refers to the seller's option to deliver the cheapest instrument when a futures contract allows several instruments for delivery.
- For example, U.S. Treasury note futures allow delivery of any Treasury note with a maturity between 6 1/2 and 10 years. Note that the cheapest-to-deliver note may vary over time.
- Those deeply involved in using T-note futures to hedge risk are keenly aware of these features.

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