14 Futures Contracts

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.

Futures 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.

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, those 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.

Financial Futures

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

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

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.

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.

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 × 100 × 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 × 100 × 100 = $8,200,000
  
  Your "long" speculation has resulted in a gain of $200,000

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.

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 × 100 × 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 × 100 × 100 = $7,700,000
  
  Your "short" speculation has resulted in a gain of $300,000
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.

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.

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?

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.

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.

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)
The Long Hedge Performance

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?

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.

Important Aspects of 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.

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.

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.
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.

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.

\[ \text{basis} = \text{cash price} - \text{futures price} \]

Cash-Futures Arbitrage, Cont.

• For commodities with storage costs, the cash price is usually less than the futures price, i.e. basis < 0. This is referred to as a carrying-charge market.

• Sometimes, the cash price is greater than the futures price, i.e. basis > 0. This is referred to as an inverted market.

• Basis is kept at an economically appropriate level by arbitrage.

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:

\[ F_T = S(1+r)^T - D \]

• In the equation, \( F_T \) 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.

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:

\[ F_T = S(1+r-d)^T \]

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.
**Single Stock Futures**

- *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.

**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.

**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.

**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, $\beta_D$, is zero.
- Suppose the beta of a portfolio, $\beta_P$, 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:
  \[
  \text{Number of contracts} = (\beta_P - \beta_D) \times \frac{V_P}{V_F}
  \]

**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?
  \[
  \text{Number of contracts} = (1.25 - 0) \times \frac{185,000,000}{1,480}
  \]
  \[
  = 625 	imes (1.25) \times \frac{185,000,000}{1,480}
  \]
  \[
  \text{S&P 500 Multiplier:}
  \]

**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.
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, $D_P$
  - Value of the bond portfolio, $V_P$
  - Duration of the futures contract, $D_F$
  - Value of a single futures contract, $V_F$

- The formula is: 
  $\text{Number of contracts needed} = \frac{D_P \times V_F}{D_F \times V_F}$

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:
  $D_F = D_U + M_F$

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?
  $\text{Number of contracts needed} = \frac{D_P \times V_F}{D_F \times V_F}$
  $= \frac{8 \times 110}{6.5 \times 0.5 \times 110} = 1,039$

Futures Contract Delivery Options

- The $\text{cheapest-to-deliver option}$ 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.