



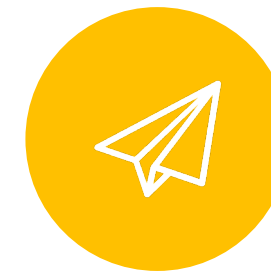
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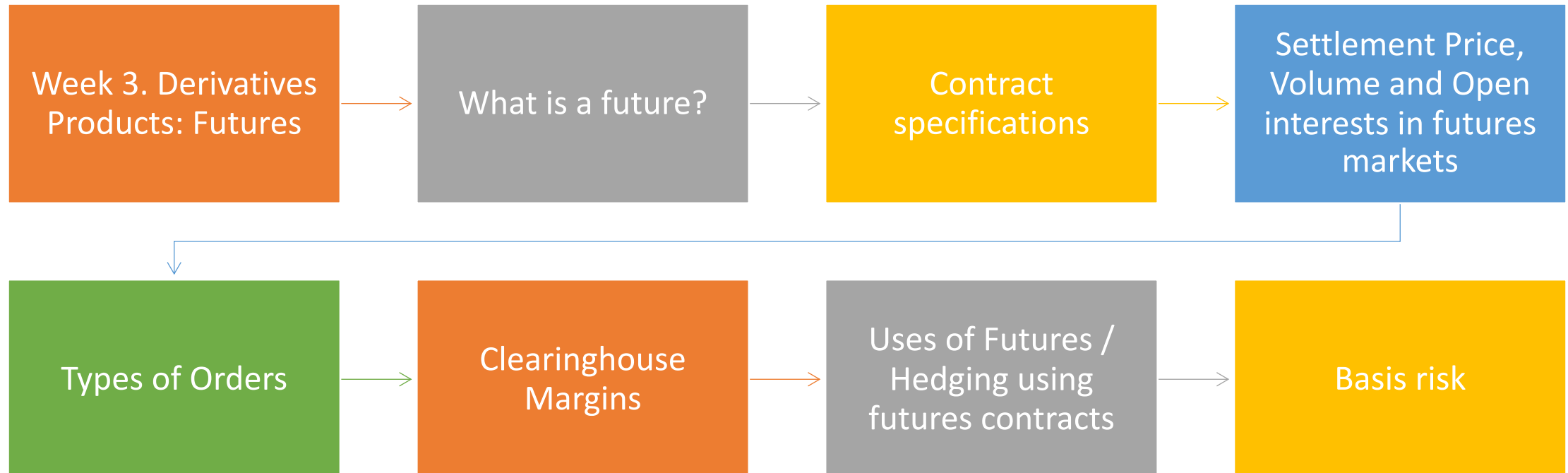
Introduction to Derivatives

Last Week

Derivatives Products: Forwards

- What is a forward?
- Use of Forwards: Hedging and Speculation
- Advantages and Disadvantages of Forwards
- Pricing Forwards

Syllabus





Week 3: Derivatives Products: Futures

Futures

- ❖ A **future contract** is a contractual agreement made between two parties to buy or sell an asset through a **regulated futures exchange** at a **certain time in the future** for a **certain price** (the delivery price)
- ❖ It is traded in the **regulated futures exchange**

Futures on what?

- Just about anything. "If you can say it in polite company, there is probably a market for it," advertises the CME.
- For example, the CME trades futures on agricultural commodities, foreign currencies, interest rates, and stock market indices, including
 - Agricultural commodities: Live Cattle, Feeder Cattle, Live Hogs, Pork Bellies, Broiler Chickens, Random-Length Lumber.
 - Foreign currencies: Euro, British pound, Canadian dollar, Japanese yen, Swiss franc, Australian dollar, ...
 - Interest rates: Eurodollar, Euromark, 90-Day Treasury bill, One-Year Treasury bill, One-Month LIBOR
 - Stock indices: S&P 500 Index, S&P MidCap 400 Index, Nikkei 225 Index, Major Market Index, FT-SE 100 Share Index, Russell 2000 Index
- Major growth since early '80s has been in financials - now the dominant sector.

Futures versus Forwards

- Futures contracts are similar to forwards, but
- Buyer and seller negotiate indirectly, through the exchange.
- Default risk is borne by the exchange clearinghouse
- Positions can be easily reversed at any time before expiration
 - That is why delivery is very rare
- Value is marked to market daily.
- Standardization: quality; quantity; Time.
 - The short position has often different delivery options; good because it reduces the risk of squeezes, bad ... because the contract is more difficult to price (need to price the “cheapest-to-deliver”).
- The different execution details also lead to pricing differences, e.g., effect of marking to market on interest calculation.

Futures versus Forwards

- Futures markets perform the risk transfer function of forward contracts but are more liquid and substantially reduce performance risk.
- Futures markets separate the *marketing* and the *purchasing* decisions (who to sell to or buy from) from the price *insurance* function of forward markets.
- As a consequence, futures markets are also useful even when marketing or purchasing do not arise - e.g. in portfolio management.



Futures versus Forwards

FORWARDS	FUTURES
Private contract between 2 parties	Exchange traded
Non-standard contract	Standard contract
Usually 1 specified delivery date	Range of delivery dates
Settled at end of contract	Settled daily
Delivery or final cash settlement usually occurs	prior to maturity
Some credit risk	Virtually no credit risk

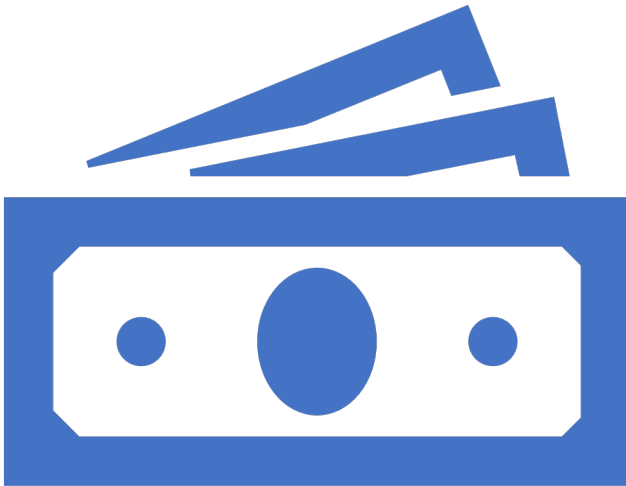
Contract Specifications

- Each futures contract specifies
 - The quantity and quality of the underlying asset
 - Delivery time
 - Delivery point
 - Settlement type (Physical delivery or cash settlement)
 - Price limits and position limits
 - Everything about transaction except price is detailed in the contract. Price is to be negotiated based on market conditions

Contract Specifications: Underlying asset, delivery month and delivery location

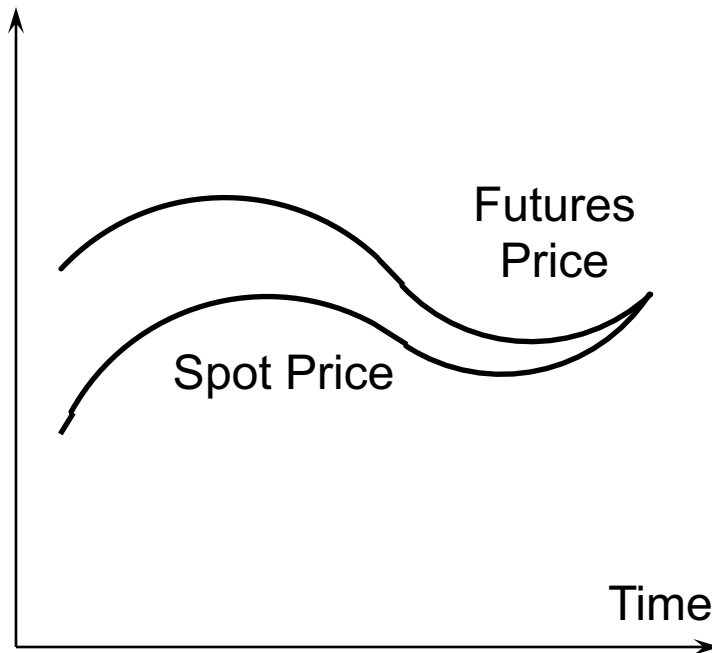
- Standardisation concentrates trading and hence liquidity in a small number of contracts.
- Standardisation by
 - grade - Chicago wheat, “No 2 Red”
 - location: Chicago Points
 - date: Jan, Mar, May, Jul, Sep, Nov.
- Liquidity is important because traders
 - need to be able to trade in size at screen-quoted prices without slippage
 - need to be sure that they can close out positions, since delivery seldom intended.

Contract Specification: Physical vs Cash Settlement

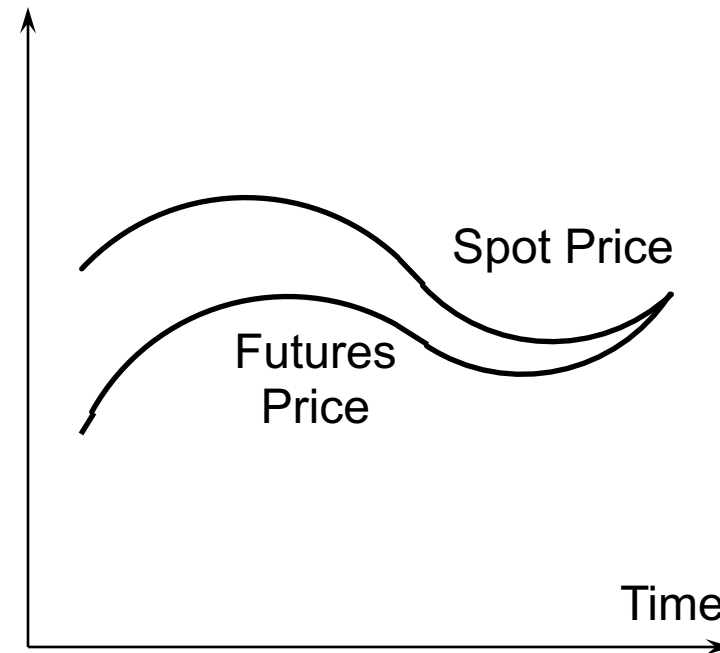


- Physical vs Cash Settlement
- Offsetting Position before the maturity
 - What happens if you don't offset your position before the maturity
 - Seller's broker informs exchange clearing house intention to deliver, specifying how many contracts will be delivered and where the delivery will be made and what grade will be delivered.
 - The exchange then chooses a party with a long position to accept the delivery.
 - So, close out your position if you don't want to take delivery
 - Unanticipated delivery of a futures contract
- Delivery and convergence of futures to spot prices

Convergence of Futures to Spot



(a)



(b)

Contract Specifications: Price Movement and Position Limits

- For most contracts, *daily price movement limits* are specified by the exchange.
- *Position limits* are the maximum number of contracts that a speculator may hold. The purpose of these limits is to prevent speculators from exercising undue influence on the market.

Settlement Price, Open Interest and Volume of Trade

- **Open Interest:** This is the total number of contracts outstanding. It is the sum of all the long positions (or equivalently it is the sum of all the short positions).
- **Volume of Trade** is the number of contracts traded in a day
 - Difference between volume of trade and open interest
- **Settlement Price:** Usually, this is the weighted average of the prices at which the contract traded immediately before the end of trading for the day. Open Price, Close(last) price, High and Low price

Friday 19,2020 CME Crude Oil WTI (CL)Futures Settlements

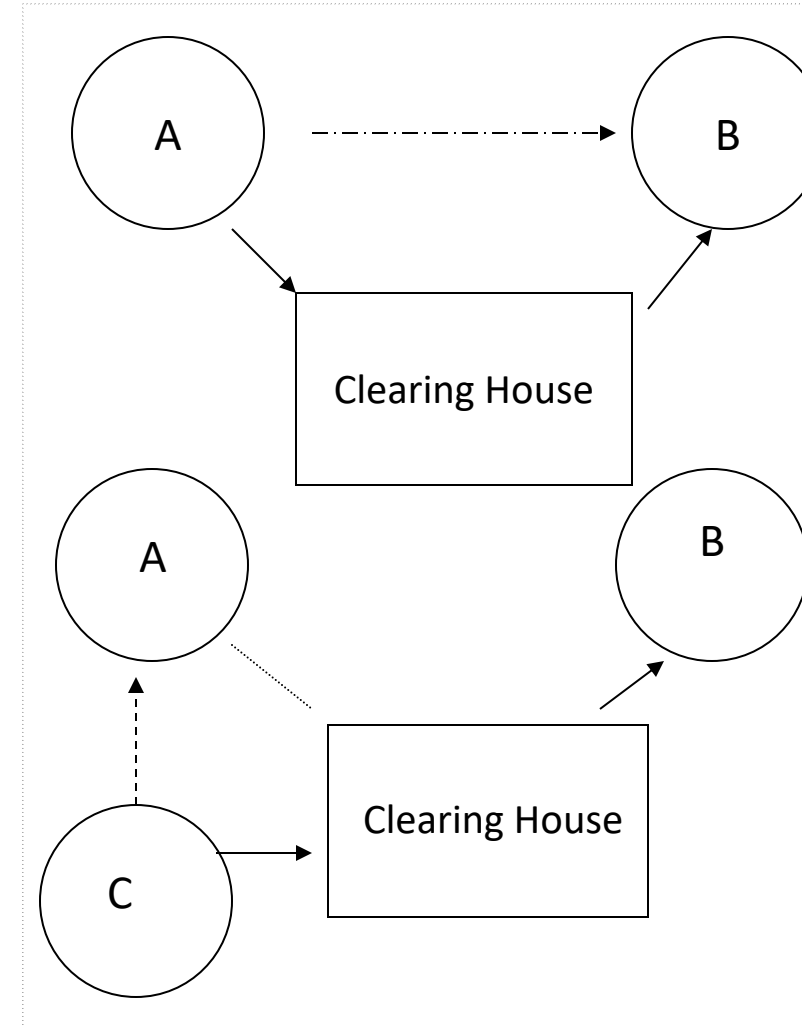
Month	Open	High	Low	Last	Change	Settlement	Estimated Volume	Prior day Open Interest
20-Jul	38.85	40.50	38.40	39.43	0.91	39.75	81,093	39,340
20-Aug	39.03	40.60	38.51	39.50	0.78	39.83	509,738	307,691
20-Sep	39.19	40.67	38.66	39.61	0.70	39.93	150,510	315,123
20-Oct	39.28	40.71	38.78	39.68	0.64	40.02	53,193	129,138
20-Nov	39.40	40.76	38.95	39.82	0.59	40.10	27,070	121,699
20-Dec	39.50	40.82	39.02	39.86	0.56	40.19	98,661	316,635

Types of Order

- Market Order
- Limit order
- Stop order or stop loss
- Stop limit
- Trade at Settlement

The Clearing House

- The exchange clearing house intermediates all futures transactions. The credit status of the counterparty became irrelevant and contracts became *fungible*. A transactor needs only worry about the credit status of the clearing house (fine in London, N.Y. and Chicago).
- Here A's contract with B is replaced by a contract with the clearing house. If C sells to A, closing out A's short position, B is uninvolved.



Marking to Market

- Marking to market ensures that futures contracts always have zero value - hence the Clearing House does not face any risk. Marketing to market takes place through *margin payments*.
- At the inception of the contract, each party pays initial margin (typically 10% of value contracted) to a margin account held by his broker. Initial margin may be paid in interest-bearing securities (t-bills) so there is no interest cost.
- If futures price rises (falls), the longs have made a paper profit (loss) and the shorts a paper loss (profit). The broker pays losses from and receives any profits into the parties' margin accounts on the morning following trading.
- Loss-making parties are required to restore their margin accounts to the required level (initial margin) during the course of the same day by payment of variation margins in cash; margin in excess of the required level may be withdrawn by profit-making parties.

Margin Example

- The maintenance margin is \$3750 and initial margin is \$5,000 per contract and each contract is 1000 barrel of WTI crude oil
- Trader X bought a ten September 2011 delivery NYMEX crude oil futures contract at a price of \$100 on 18 Feb 2011 .
- The broker will require the investor to deposit an initial margin of \$50 000 in the margin account.
- At the end of each day, the margin account is adjusted to reflect the investor's gain or loss. This practice is known as marking to market the account.

Margin Example

Day	Futures Prices of WTI Crude Oil (\$/bbl)	Daily Gain or (loss)	Cumulative Gain (Loss)	Margin Account Balance	Margin Call
18-Feb	100			50 000	
21-Feb	99.5	-5 000	-5 000	45 000	
22-Feb	98	-15 000	-20 000	30 000	20 000
23-Feb	99	10 000	-10 000	60 000	
24-Feb	98.5	-5 000	-15 000	55 000	
25-Feb	97	-15 000	-30 000	40 000	
28-Feb	95	-20 000	-50 000	20 000	30 000
01-Mar	95	0	-50 000	50 000	
02-Mar	99	40 000	-10 000	90 000	
03-Mar	99	0	-10 000	90 000	
04-Mar	100	10 000	0	100 000	

Another Margin Example

Suppose that you enter into a short futures contract to sell August NG contract for \$1.75 per MMBtu.

- The size of the contract is 10,000 MMBtu.
- The initial margin is \$2,000, and the maintenance margin is \$1,700.
- What change in the futures price will lead to a margin call?

Uses of Futures Contract



HEDGING



SPECULATION



ARBITRAGE

Hedging using Futures

- A long futures hedge is appropriate when you know you will purchase an asset in the future and want to lock in the price.
- A short futures hedge is appropriate when you know you will sell an asset in the future and want to lock in the price.
- By hedging away risks that you do not want to take, you can take on more risks that you want to take while maintaining the aggregate risk levels.
 - Companies can focus on the main business they are in by hedging away risks arising from interest rates, exchange rates, and other market variables.
 - Insurance companies can afford to sell more insurance policies by buying re-insurance themselves.
 - Mortgage companies can sell more mortgages by packaging and selling some of the mortgages to the market.

Hedging, not perfect always

- Standard futures markets trade only a small number of contracts per year.
- This concentrates liquidity and gives good execution. However, it implies that contract maturity dates are unlikely to coincide exactly with desired hedge dates.
- Example - LCE (LIFFE) Cocoa trades Mar, May, Jul, Sep & Dec with contracts maturing on 3rd Friday of delivery month.
- This gives rise to basis (structure) risk since the term of the contract and the term of the hedge differ.

Basis risk

- Basis is the difference between spot price of asset to be hedged and futures price of contract used ($S - F$).
- Basis risk arises because of the uncertainty about the basis when the hedge is closed out.
- Let ($S_1; S_2; F_1; F_2$) denote the spot and futures price of a security at time 1 and 2.
 - Long hedge: Entering a long futures contract to hedge future purchase:

Future Cost = $S_2 - (F_2 - F_1) = F_1 + \text{Basis}$:

- Short hedge: Entering a short futures contract to hedge future sell:

Future Profit = $S_2 - (F_2 - F_1) = F_1 + \text{Basis}$:

Two Interesting Questions (1)

- What is the relationship of the futures price F_{01} to the current spot price S_0 ?
 - Backwardation/contango.

Two Interesting Questions (2) (Commodity)

- What is the relationship of the futures price F_{0T} to the future spot price S_T ? Risk premium/bias.
 - The Expectation Hypothesis of futures prices states that:
$$F_{0T} = E_0(S_T) \text{ (risk neutrality assumption).}$$
 - Keynes (1930) first proposed that futures prices contain a risk premium (the Expectation Hypothesis does not work)
 - Hedgers are (usually) short futures \implies speculators are long: The only way speculators are willing to be long is if they expect to earn higher returns $\implies F_{0T} < E_0(S_T) \implies$ “normal Backwardation”
 - Normal Contango: $F_{0T} > E_0(S_T)$.

Advantages of Futures



Regulated



Segregated accounts



Clearinghouse takes credit and operations risks



Liquid and transparent



Standardized (no surprises)

Disadvantages of Futures



Smaller volumes than OTC



Not available for all assets



Standardised



Still have exposure to market risk (basis risk)



Not as anonymous as OTC?

Next Week





Thank You

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