Lecture 1: Introduction to Derivatives

- Futures contract is an agreement to buy/sell a specified quantity of a specified asset at a specified time in the future for a specified price (delivery price)
- Deposit: buyer pay small portion of delivery price (2-5%)
- Spot contract is an agreement to buy/sell asset immediately (within very short period of time -> pay now)

What is derivatives

- Derivative is a financial security contract whose value depends on the prices of one or more underlying assets
- Value comes from the fluctuations of values of underlying asset

Types of Derivatives

- Futures and forward contracts
- Standard/plain vanilla options
- Primarily written on underlying assets

Derivatives trading

1. Exchange

- Products and trading terms are standardised and heavily regulated
- Use open outcry system: traders physically meet to exchange
- Increasingly replaced by electronic trading where computer matches buyers and sellers

2. Over the counter (OTC)

- Unregulated and flexible trade between 2 private parties
- Telephone and computer linked network of dealers who don't physically meet
- Trades between financial institutions, corporate treasures and fund managers
- Credit risk
- Greater possibility of counterparts risk (one of the parties default)

Advantages of derivatives

1. To hedge risk (insurance)

- Eg: Sell crop in dec

What to do:

- wait until dec and sell (price uncertain)
- sell futures (go short) in dec (sales price determined)

Through future contracts, locks in price

2. To speculate (view on future direction of market value)

- Eg: Investor feels that price will increase next 2 months.

Current spot price is $4 and future price for contract is $4.20

What to do:

- Buy spot 5000units, put $20,000 down now
- Buy futures (go long), no money down but a 5% deposit

Futures allow more leverage which increase rate of return and increase losses quicker

3. To lock in an arbitrage profit (free lunch)

- Eg: Stock price is 100 pounds in London and $182 in New York

Current exchange rate is 1.85

Traders take advantage of similar opportunities via derivatives

Disadvantage of derivatives

- Difficult to value because they are based on price of another asset
- Counter party risk are difficult to predict or value
- Sensitive to changes in time to expiration, cost of underlying asset and interest rates
- No intrinsic value (value only from asset, vulnerable to market risk) Supply and demand factors cause derivative prices and liquidity to rise and fall regardless of price of underlying asset

Who uses derivatives? For what purpose?

1. Risk management - hedging
2. Proprietary trading groups exploiting - arbitrary
3. Speculators - engage in leveraged bets
4. Hedge fund - trade derivatives for all 3 reasons

Derivatives misuse: When trader has a mandate to use derivatives for hedging or arbitrage but switches to speculation which may result in large losses.

Futures and Forward Markets

Futures

- Derivative financial contracts obligating buyer to purchase or seller to sell asset at predetermined future date and price
- Detail quantity of asset and standardized to facilitate trading on futures exchange

Advantages:

- Speculate on direction of price of asset
- Hedge price they want to sell to protect from unfavourable price movements
- Require deposit of a fraction of a contract with broker

Disadvantages:

- Risk of losing more than initial margin amount since futures use leverage
- Miss out on favourable price movements
- Double-edged sword (gains amplified, losses too)

Exchange trading

- Contract between 2 parties replaced with separate contracts with an intermediary (clearinghouse: ensure process from trade to settlement is smooth)
- Clearinghouse: - Be both buyer and seller (subject to default risk from both parties)
  - Monitor credit risk (reduce cost and risk of settling multiple transactions among multiple parties)

Opening future positions

- Call broker/enter into contract via online trading account
- Contracts referred to by their delivery month (eg: Long May WTI, oil futures)
- No initial payment (except bid-ask spreads, commissions and margins)
- Price agreed upon today: price transactions will take place in the future

Closing out futures positions

2 options: take delivery or reverse a position

- Most contracts don't lead to delivery (less than 2%)
  - Inconvenient (speculators)
  - Expensive (storage cost, transport)
- Reverse a position (before delivery)
  - Enter into contract that is opposite of the original contract
  - Eg: March 6: Long 1 July corn and April 12: Short 1 July corn
  - Profit/loss determined by change in futures price between March 6 and April 12

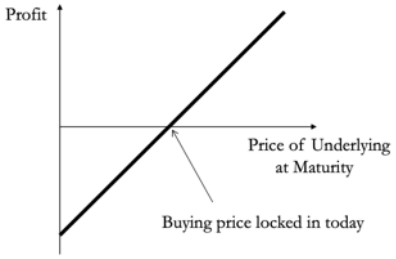
whenever a position is open. it is not taken until expiration. it is closed out before expiration

Delivery

- If futures contract is not closed out before maturity, it is settled by delivering the assets underlying the contract
- When there are alternatives about what, where and when it is delivered, the short position party chooses
- Few contracts are necessarily (always) settled in cash - never taken to expiration
- The short party decides the date and location of delivery

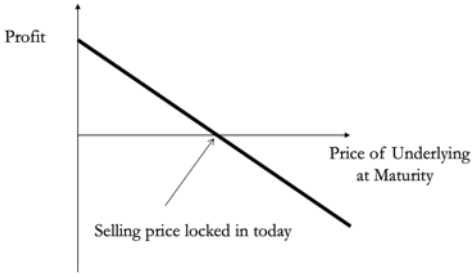
Payoffs to Long and Short positions

Profit/losses from long futures position



- Buyer of underlying
- Receive an asset at today's future price
- Profit: spot price increases
- Payoff (when closing out) = Spot - Futures

Profit/losses from short futures position



- Seller of underlying
- Deliver an asset at today's futures price
- Profit: spot price decreases
- Payoff (when closing out) = Futures - Spot

Marking to market

- Difference between today's and yesterday's settlement prices
- Positive difference: long position's account is credited
- Negative difference: short position's account is credited

An investor takes a long position in 2 December gold futures contracts on June 5

- contract size is 100 oz.
- futures price is US$400
- margin requirement is US$2,000/contract (US$4,000 in total)
- maintenance margin is US$1,500/contract (US$3,000 in total)

Day	Futures Price (US$)	Daily Gain (Loss) (US$)	Cumulative Gain (Loss) (US$)	Margin Account Balance (US$)	Margin Call (US$)	
	400.00			4,000		
5-Jun	397.00	(600)	(600)	3,400	0	
⋮	⋮	⋮	⋮	⋮	⋮	
13-Jun	393.30	(420)	(1,340)	2,660	+ 1,340	= 4,000
⋮	⋮	⋮	⋮	⋮	⋮	< 3,000
19-Jun	387.00	(1,140)	(2,600)	2,740	+ 1,260	= 4,000
⋮	⋮	⋮	⋮	⋮	⋮	
26-Jun	392.30	260	(1,540)	5,060	0	

Margins and marking-to-market

- Initial margin = amount of money deposited by investor to broker as guarantee that cover any loss in future on futures contract to investor (5% of the value of a contract)
- Maintenance margin: minimum amount of equity investor maintain in margin account (75% of initial margin)
- Daily settlement: Cash exchange between parties occur at the end of each trading day
- Marking to market: Margin accounts are adjusted daily to reflect gains and losses
- If losses above certain level, investor required to deposit further margin
- Unlikely that brokers will default on contract with clearing house member
- Unlikely that clearing house member will default with clearing house
- Margin call: If the balance in the margin account dips below the maintenance margin
- Need to post additional margin or the position is closed out (liquidate it)

Futures Price Quotes

- Open interest: - Total number of contracts outstanding
  - Equal to number of long/short positions
  - Indicates liquidity of the contract
- Settlement price: Price just before the final bell each day
- Volume of trading: Number of trades in 1 day

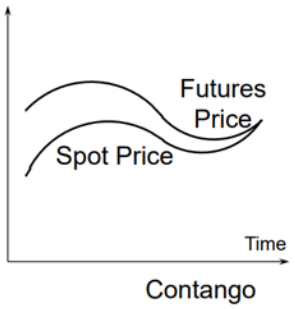
Convergence of futures price to spot price

- As futures approaches expiration, futures price converges to spot price
- Otherwise, there is an arbitrage opportunity (wont last long, take advantage of the difference)

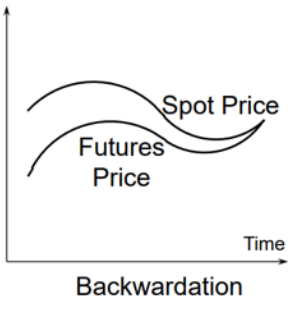
Example:

Assume futures is above the spot at maturity $F_T > S_T$

- sell overvalued security and buy undervalued one.
- Arbitrageurs sell (short) a futures contract, buy the asset, and make the delivery.
- → Futures price ⇩ & spot price ⇧
- Continue until prices are equal (subject to transaction costs)



Contango



Backwardation

Forward contracts

- Customised contract to buy/sell certain quantity of a certain asset at certain time in the future for a certain price
- Trade in the over-the-counter market (easier to customise terms)
- Lack of clearinghouse lead to increased default risk
- No daily settlement: End of the life of the contract, one party buys the asset for the agreed price from the other party
- Forward contracts are more popular on currencies and interest rates

Forward	***Futures***
Private contract between two parties (OTC)	Traded on an exchange
Not standardized	Standardized
Usually one specified delivery date	Range of delivery dates
Settled at end of contract	Settled daily
Delivery or final settlement usual	Usually closed out prior to maturity
Some credit risk	Virtually no credit risk