



# Introduction to Derivatives Market

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# Derivatives

- Derivative
  - Financial Instrument whose value derived from an underlying asset
  - Financial Contract
- Underlying Assets
  - Stocks, Bonds, Currencies, Commodities, Interest Rates etc
- Example - Equity Option
  - Equity Option is not a security by itself
  - It is right to sell or buy an underlying security
  - Only premium is paid to buy an option NOT the price of the underlying equity

# Derivative Markets

- Exchanges
  - Intermediary who accommodates the trade and guarantees the execution
  - Collects the Margin if applies
  - Specialized Derivatives Exchanges
  - Regular Exchanges
- OTC (Over-the-counter)
  - Direct Contract between two parties
  - Non-standard contracts

# Major Classes of Derivatives

- Futures and Forwards
  - DJIA Index Future, Eurodollar Future, Bond Future, FX Future etc
  - FX Forward, Repos, FRA etc
- Options
  - Stock Option, Warrant etc
- Swaps
  - Interest Rate Swap
  - Currency Swap etc

# Futures

# Futures Contract

- A legally binding agreement to sell or buy a commodity or financial instrument some time in future
- Futures are standardized according to quality, quantity, and delivery time and location for each commodity
- Price of futures is discovered on an exchange trading floor
- Exchange takes some responsibility for futures approved/sold on the floor
- Futures contract needs funds to be deposited (margin) by buyer/seller as a guarantee

# Futures cont..

- Futures can be settled with cash instead of delivery of the actual underlying asset
- Futures contracts are available on
  - Corn and other grains
  - Crude oil
  - Treasury bond
  - Foreign currency
  - Stock and other financial instruments

# Futures Positions

- Long position – purchasing the futures contract (to buy the asset in future)
  - Hedgers can use to hedge from rising prices
  - Speculators can use in anticipation of higher prices
- Short position – selling the futures contract (to sell the asset in future)
  - Hedgers can use to hedge from falling prices
  - Speculators can use in anticipation of lowering prices

# Forwards

- Non-standardized futures contracts
- Contract between two individual parties
- Sold in OTC Markets
- Usually Brokerage Institutions arrange deals
- Carry the risk of default
- Futures are interchangeable; Forwards are not

# Forward

- Similar to Futures Contract but not Standard
- Traded between two private parties (in OTC Markets)
- On delivery date, holder may actually deliver the instrument or pay the price difference
- Riskier than Futures
- Popular on Currencies and Interest Rates

# Futures Vs Forwards

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- Exchange Traded
  - Usually closed out prior to maturity
  - Standardized
  - Settled daily
- OTC Traded
  - Usually underlying asset delivered
  - Terms vary
  - Settled at expiry

# Options and Futures Exchanges

- Chicago Board of Trade – CBOT  
[www.cbot.com](http://www.cbot.com)
- Chicago Mercantile Exchange – CME  
[www.cme.com](http://www.cme.com)
- New York Mercantile Exchange – NYMEX  
[www.nymex.com](http://www.nymex.com)

# Option

- Right to buy or sell an underlying instrument
- Just premium is paid to buy the option not the value of the underlying asset
- It is just a **RIGHT** not an **OBLIGATION**
  - Holder may not execute his right at all
- Popular Options
  - Stock option
  - Bond option
  - Commodity option
  - Interest Rate option
  - FX option etc.

# SWAP

- Is an agreement between two parties to swap one set of CASH FLOW with another set
- For example, holder of Fixed interest rate loan may exchange his cash flow (return stream) with a party who holds Floating rate loan cash flow
- Traded in OTC Derivatives Markets
- Various SWAPs
  - Interest Rate Swap
  - Currency Swap etc

# Why Derivatives?

- Hedging / Insurance
  - Transfer the RISK
  - Ex: Farmer selling a crop before its harvest to protect from any future fluctuations in prices
- Arbitrage
  - Buying an instrument in one market and selling in another and profiting from the difference
- Speculation
  - Speculating the price variation in instrument and buying futures or options of that instrument

# Why Derivatives? ...cont

- To change the nature of liability
- To change the nature of the investment without selling the instrument itself etc.

# Hedging Example

- Own a 1000 shares of IBM. Market Value \$100/share
- Worried about possible price decline over next 3 months
- Need a protection from a decline OR
- Lock-in at certain price
- Hedging choice
  - Buy options to protect
  - Sign a forward contract to lock-in the price

# Hedging Example - Options

- Buy IBM PUT OPTION on some exchange
  - 3 months expiry
  - Strike price \$98
  - Option price \$4
  - 10 contracts ( $10 * 100 * 4 = \$4000$ )
- Cost of strategy is \$4000
- If the market price falls below \$98, option can be exercised at \$98 returning \$98,000
- The final amount realized  $98000 - 4000 = \$94,000$  (regardless how low the stock price is)

# Hedging Example - Options

- If the market price stays above \$98, Option is not exercised and it expires
- The final amount realized  $98000 - 4000 = \$94,000$  (regardless how low the stock price is)
- The cost of the strategy is \$4000 and the value of the holding is always above \$94,000

# Hedging Example - Options



# Speculation

- Betting on either price of the asset goes up or down
- Speculators can use any derivative
  - Future/Forward
  - Option
- Speculator needs to deposit nominal amount to buy future
- Speculator needs pay the premium to buy the option
- In case of Future speculator may make or lose LARGE amount of money
- In case of Option Losses are limited to the premium paid

# Speculation Example

- Betting on either price of the asset goes up or down
- Assume speculator in US thinks that EURO will strengthen over next 3 months (Sep)
- He is willing to be on amount worth of E250,000
- He buys Futures contract
  - Futures price 1.6410
  - Buy 4 futures
  - Each contract on E62,500

# Speculation Example

- If in September the SPOT price is 1.7000
  - Profit made is
  - $(1.7 - 1.6410) * 250,000 = 14,750$
- If in September the SPOT price is 1.6000
  - Loss is
  - $(1.6410 - 1.600) * 250,000 = 10,250$

# Arbitrage

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- Locking the profit by simultaneously entering into contracts in multiple markets
- Buy instrument in one market and sell in another market
- Benefit from the spread in the markets

# Arbitrage Example

- Assume US/EURO spot price 1.75
- Assume the stock is trading in NYSE at \$172 and in LSE trading at E100
- Arbitrageur see an opportunity and trades the stock
- Profit made is
  - $100 * \{(1.75 * 100) - 172\} = \$300$
- On large volumes profits exceed transaction costs

# Pros and Cons of Derivatives

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- Speculation is very dangerous
- Hedging is mandatory to protect
- Arbitrage is an opportunity to make money (worse case losses are limited)
- When some hedgers become speculators it may cause disasters

# More on Derivatives

# Options Vs Futures

- Options Contract
  - Provides the insurance
  - Protects from adverse future movements
  - Benefit from favorable future movements
  - Upfront cost is involved
- Futures Contract
  - Neutralize the Risk
  - Protects from adverse future movements but also limit returns from favorable movements
  - No upfront cost

# Options and Hedging

- A **call** is used primarily as a hedge for upside market movement.
- A **call** is also used to hedge downside exposure as an alternative to buying the underlying.
- Call's: The buyer and seller have opposite views about the market's potential to move higher.
- A **put** option hedges a decline in the value of an underlying asset.
- Put's: The buyer and seller have opposite views about the market's potential to move lower.

# Upper Bounds on Option Prices

- Any **call** price must be less than the current stock price. If not, you are better off just buying the stock.
  - Alternatively an arbitrageur can easily make a risk-less profit by buying stock and selling the call option
- Any **put** price must be less than the strike price. If not, you are better off just selling the stock.
  - Alternatively an arbitrageur could make a risk-less profit by selling the option and investing the proceeds of the sale at the risk-free interest rate.

# Lower Bounds on Option Prices

- Any **call** price must be greater than the current stock price minus the PV of the strike price. If not, you are better off just buying the stock.
  - Alternatively an arbitrageur can buy the call and short the stock. Invest the +ve cash flow at risk-free interest rate. At the end the option either expires or is exercised, and the short position is closed. Either way he make profit.

## Lower Bounds on Option Prices(2)

- Any **put** price must be greater than the PV of the strike price minus the current stock price. If not, you are better off just selling the stock.
  - Alternatively an arbitrageur can borrow at risk-free interest rate to buy both put and the stock. At the end option either expires or is exercised, and stock is also sold. The loan amount is repaid, leaving some profit.

# Typical Option Positions

- Options are usually bought and sold in combination with other options and/or shares of the underlying stock.
- This is a form of hedging: taking a position that limits possible losses.
  - A hedged position also limits possible gains.
  - Un-hedged positions are risky, and are used for speculation.
- These are referred as Option Trading Strategies

# Swaps

# Swaps

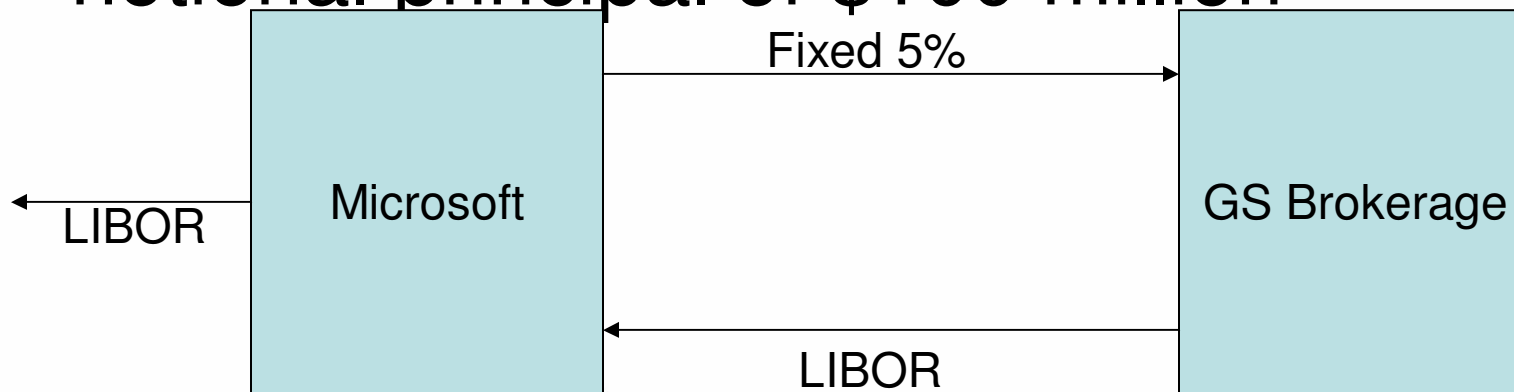
- A swap is an agreement to exchange cash flows at specified future times according to certain specified rules
- Swap trading
  - Mostly on OTC market
  - Simple swaps on Futures Exchange
- Swap Types
  - Interest Rate Swap (Plain Vanilla)
  - Currency Swap
  - Credit swap
  - Equity swap etc

# Interest Rate Swap

- A company agrees to pay cash flows equal to interest at a predetermined fixed rate on a notional principal for a number of years. In return, it receives interest at floating rate on the same notional principal for the same period of time.

# Swap - Example

- An agreement by Microsoft to receive 6-month LIBOR & pay a fixed rate of 5% per annum every 6 months for 3 years on a notional principal of \$100 million



# Cash Flows

Date	In Millions			Net
	LIBOR Rate	<i>FLOATING</i> Cash Flow	<i>FIXED</i> Cash Flow	
Mar.5, 2004	4.2%			
Sept. 5, 2004	4.8%	+2.10	-2.50	-0.40
Mar.5, 2005	5.3%	+2.40	-2.50	-0.10
Sept. 5, 2005	5.5%	+2.65	-2.50	+0.15
Mar.5, 2006	5.6%	+2.75	-2.50	+0.25
Sept. 5, 2006	5.9%	+2.80	-2.50	+0.30
Mar.5, 2007	6.4%	+2.95	-2.50	+0.45

# Use of Swaps

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- Converting a liability from
  - fixed rate to floating rate
  - floating rate to fixed rate
- Converting an investment from
  - fixed rate to floating rate
  - floating rate to fixed rate

# Pricing/Valuation

# Valuation/Pricing

- Value/Fair Value/Price
- Valuation
  - Process of finding the value of position
- Methods/Measures
  - Fundamental Analysis
  - Technical Analysis
  - Quantitative Analysis etc
- Market Value
  - Value in the Market or Current Quote (Asking and Bidding price)
- Arbitrage-free Value
  - Theoretical price of asset computed using spot/futures price, interest rates, carrying costs and all other costs

# Valuation/Pricing cont..

- Intrinsic Value
  - True value of the asset (calculated considering all affecting parameters)
- Net Asset Value (NAV)
  - Total Value of the Asset less Liabilities
- Book Value
  - Value of an asset shown in the Balance Sheet (cost – depreciation)

# Fundamental Analysis

- Type of Valuation that is used to identify the true value of the asset
- Uses all factors that affect asset price
- Example:
  - Stock Valuation – uses factors like revenues, earnings, future growth, return on equity, profit margins etc

# Technical Analysis

- Method of Valuation that is used to identify the value of the asset using historical data instead of using actual factors that affect the value
- Based on belief that historical performance is the indication of the future performance
- Typically use Charts

# Quantitative Analysis

- Way of valuating assets using complex mathematical and statistical modeling, measurement and research
- It assigns numerical value to all variable that affect the asset value
- Analysts referred as
  - “Quants” OR “Quant Jockeys”
- Examples of Quantitative Analysis measures are, from simple Earnings Per Share to complex Option Price
- Involves Mathematical Finance, Numerical Methods, Statistics etc.