INSTITUTE OF AERONAUTICAL ENGINEERING

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POWER PONT PRESENTATION

on

FINANCIAL DERIVATIVES

MBA IV SEMESTER

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UNIT - I

INTRODUCTION TO DERIVATIVES

Development and growth of derivative markets

- derived function: the result of mathematical differentiation; the instantaneous change of one quantity relative to another.
- derivative instrument: a financial instrument whose value is based on another security
- Risk is a characteristic feature of most commodity and capital markets

Introduction

- **There is no universally satisfactory answer to the question of what a derivative is**
- **Often when a market participant suffers a large newsworthy loss, the term "derivatives" is used almost as if it were an explanation**
  - **"anything that results in a large loss"**
  - **"dreaded D word"**
  - **"beef derivative"**

Introduction (cont'd)

- **Futures and options markets are very useful, perhaps even essential, parts of the financial system**

- **Futures and options markets have a long history of being misunderstood**

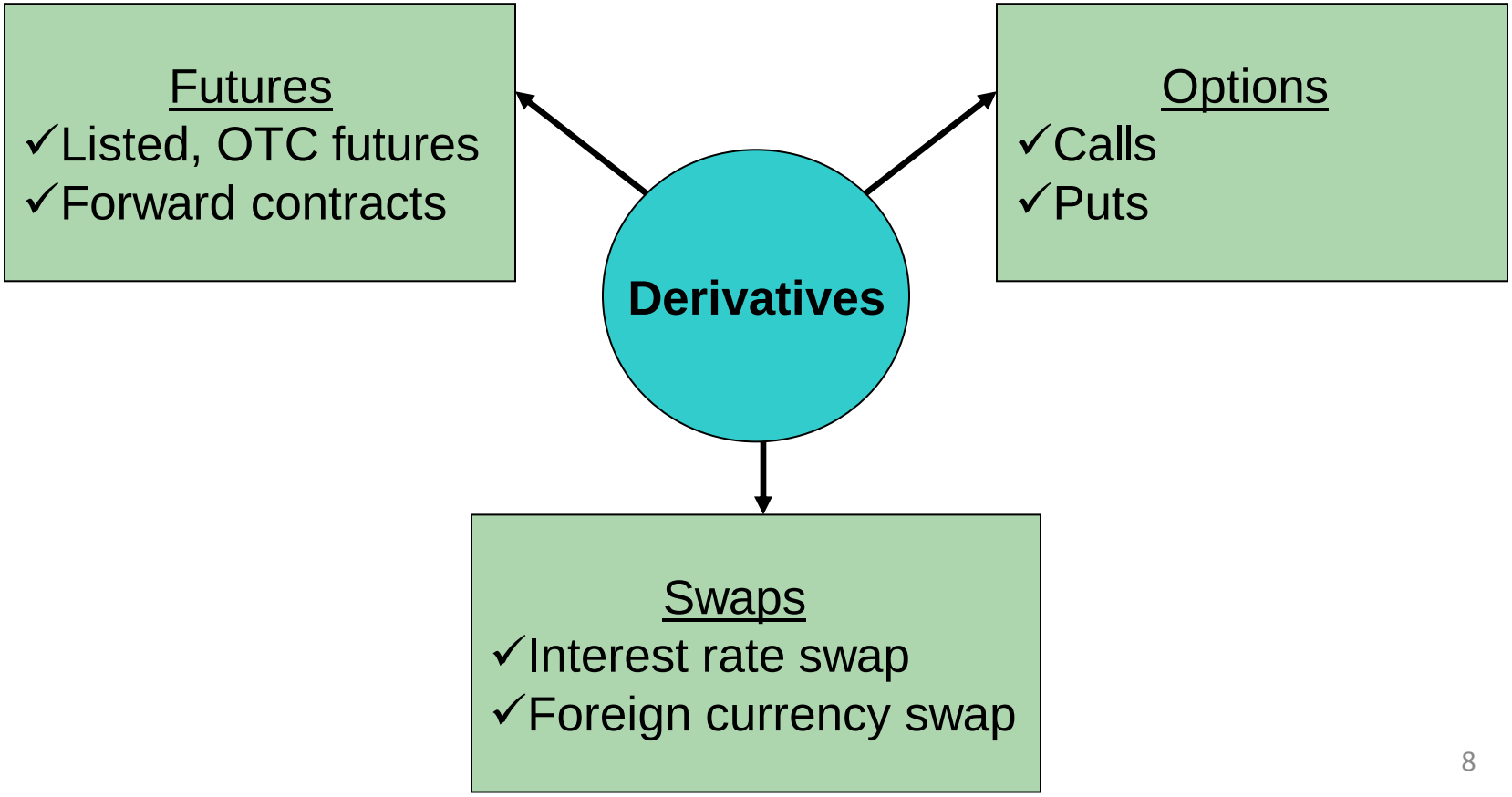
Introduction (cont'd)

- **"What many critics of equity derivatives fail to realize is that the markets for these instruments have become so large not because of slick sales campaigns, but because they are providing economic value to their users"**
  - **Alan Greenspan, 1988**

Types of Derivatives

- **Categories of derivatives**
- **Options**
- **Futures contracts**
- **Swaps**
- **Product characteristics**

Categories of Derivatives



Options

- **An *option* is the right to either buy or sell something at a set price, within a set period of time**
  - **The right to buy is a *call option***
  - **The right to sell is a *put option***

- **You can exercise an option if you wish, but you do not have to do so**

Futures Contracts

- ***Futures contracts*** **involve a promise to exchange a product for cash by a set delivery date**

- **Futures contracts deal with transactions that will be made in the future**

Futures Contracts (cont'd)

- **Futures contracts are different from options in that:**
  - **The buyer of an option can abandon the option if he or she wishes**
  - **The buyer of a futures contract cannot abandon the contract**

Futures Contracts (cont'd)

Futures Contracts Example

The futures market deals with transactions that will be made in the future. A person who buys a December U.S. Treasury bond futures contract promises to pay a certain price for treasury bonds in December. If you buy the T-bonds today, you purchase them in the cash, or *spot market*.

Futures Contracts (cont'd)

- **A futures contract involves a process known as *marking to market***
  - **Money actually moves between accounts each day as prices move up and down**

- **A *forward contract* is functionally similar to a futures contract, however:**
  - **There is no marking to market**
  - **Forward contracts are not marketable**

Swaps

- **Introduction**
- **Interest rate swap**
- **Foreign currency swap**

Introduction

- ***Swaps*** **are arrangements in which one party trades something with another party**

- **The swap market is very large, with trillions of dollars outstanding**

Interest Rate Swap

- **In an *interest rate swap*, one firm pays a fixed interest rate on a sum of money and receives from some other firm a floating interest rate on the same sum**
  - **Popular with corporate treasurers as risk management tools and as a convenient means of lowering corporate borrowing costs**

Foreign Currency Swap

- **In a *foreign currency swap*, two firms initially trade one currency for another**
- **Subsequently, the two firms exchange interest payments, one based on a foreign interest rate and the other based on a U.S. interest rate**
- **Finally, the two firms re-exchange the two currencies**

Product Characteristics

- **Both options and futures contracts exist on a wide variety of assets**
  - **Options trade on individual stocks, on market indexes, on metals, interest rates, or on futures contracts**
  - **Futures contracts trade on products such as wheat, live cattle, gold, heating oil, foreign currency, U.S. Treasury bonds, and stock market indexes**

Product Characteristics (cont'd)

- **The *underlying asset* is that which you have the right to buy or sell (with options) or the obligation to buy or deliver (with futures)**

- ***Listed derivatives* trade on an organized exchange such as the Chicago Board Options Exchange or the Chicago Board of Trade**

Product Characteristics (cont'd)

- ***OTC derivatives*** **are customized products that trade off the exchange and are individually negotiated between two parties**
- **Options are securities and are regulated by the Securities and Exchange Commission (SEC)**
- **Futures contracts are regulated by the Commodity Futures Trading Commission (CFTC)**

Participants in the Derivatives World

- **Hedging**
- **Speculation**
- **Arbitrage**

Hedging

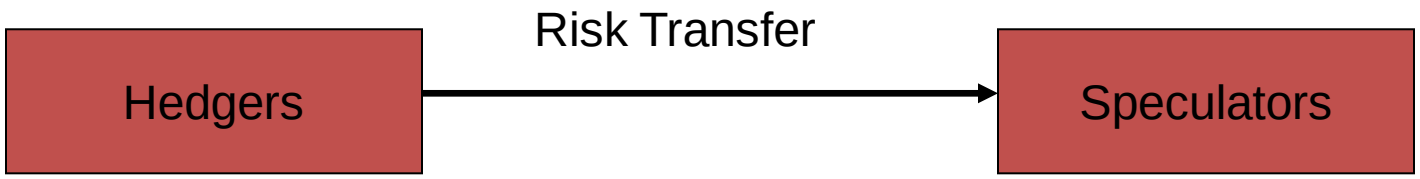
- **If someone bears an economic risk and uses the futures market to reduce that risk, the person is a *hedger***

- **Hedging is a prudent business practice and a prudent manager has a legal duty to understand and use the futures market hedging mechanism**

Speculation

- **A person or firm who accepts the risk the hedger does not want to take is a *speculator***
- **Speculators believe the potential return outweighs the risk**
- **The primary purpose of derivatives markets is not speculation. Rather, they permit the transfer of risk between market participants as they desire**

Hedgers and Speculators



Arbitrage

- ***Arbitrage*** **is the existence of a riskless profit**

- **Arbitrage opportunities are quickly exploited and eliminated**

Arbitrage (cont'd)

- **Persons actively engaged in seeking out minor pricing discrepancies are called *arbitrageurs***
- **Arbitrageurs keep prices in the marketplace efficient**
  - **An efficient market is one in which securities are priced in accordance with their perceived level of risk and their potential return**

Uses of Derivatives

- **Risk management**
- **Income generation**
- **Financial engineering**

Risk Management

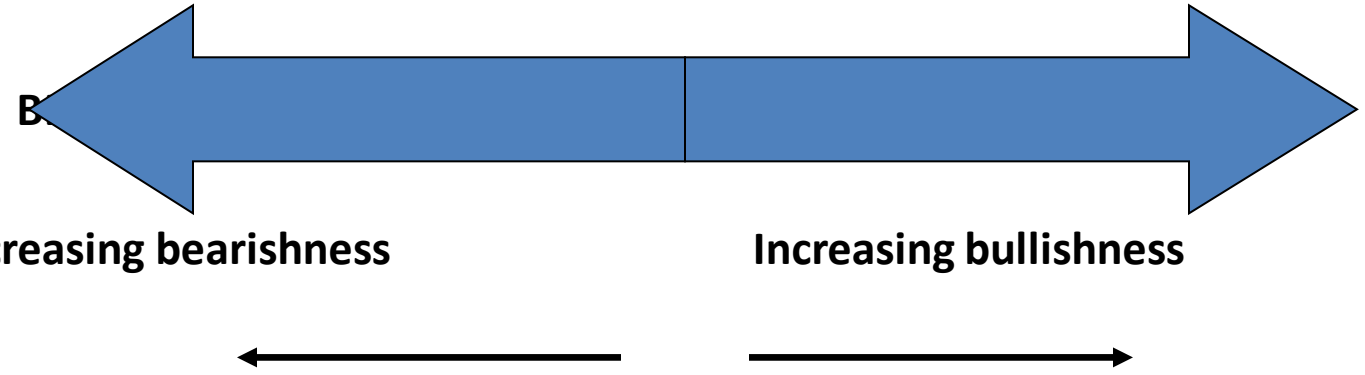
- **The hedger's primary motivation is risk management**
  - **"Banks appears to have effectively used such instruments to shift a significant part of the risk from their corporate loan portfolios"**
    - **Alan Greenspan, 2002**

Risk Management (cont'd)

- **Someone who is *bullish* believes prices are going to rise**
- **Someone who is *bearish* believes prices are going to fall**
- **We can tailor our risk exposure to any points we wish along a bullish/bearish continuum**

Risk Management (cont'd)

FALLING PRICES EXPECTED **FLAT MARKET EXPECTED** **RISING PRICES EXPECTED**



Income Generation

- **Writing a *covered call* is a way to generate income**
  - **Involves giving someone the right to purchase your stock at a set price in exchange for an up-front fee (the option premium) that is yours to keep no matter what happens**
- **Writing calls is especially popular during a flat period in the market or when prices are trending downward**

Financial Engineering

- ***Financial engineering*** **refers to the practice of using derivatives as building blocks in the creation of some specialized product**

- **Financial engineers:**
  - **Select from a wide array of puts, calls futures, and other derivatives**
  - **Know that derivatives are neutral products (neither inherently risky nor safe)**

Effective Study of Derivatives

- **The study of derivatives involves a vocabulary that essentially becomes a new language**
  - **Implied volatility**
  - **Delta hedging**
  - **Short straddle**
  - **Near-the-money**
  - **Gamma neutrality**
  - **Etc.**

Effective Study of Derivatives (cont'd)

- **All financial institutions can make some productive use of derivative assets**
  - **Investment houses**
  - **Asset-liability managers at banks**
  - **Bank trust officers**
  - **Endowment fund managers**
  - **Mortgage officers**
  - **Pension fund managers**
  - **Etc.**

fundamental linkages between spot and derivative markets,

The agricultural production system in India has undergone profound changes over the decades due to adoption of green revolution technologies coupled with price support policy of the government . After independence, various policy initiatives undertaken for protecting agriculture sector affected the growth in agricultural commodities markets adversely. The Essential Commodities Act 1955 envisaged price and movement protection applicable to various agricultural commodities, particularly food grains such as paddy, wheat, coarse grains and pulses to protect the interests of producers as well as of consumers. During the process of economic liberalization, it was felt that there is a need to reorient policies and regulations in agricultural commodities. The Khusro Committee recommended reintroduction of futures trading in most of the major commodities . The Government of India constituted another committee headed by Professor K.N. Kabra in June 1993 on Forward Markets , which also emphasized the need for introduction of futures trading in 17 commodity groups covering a wide range of agricultural commodities. It also recommended strengthening of the Forward Markets Commission (FMC) and various amendments in Forward Contracts (Regulation) Act 1952 to bring fairness and efficiency in futures trading operations.

the role of derivatives market

- Risk Management
- Price discovery
- Operational advantages
- Market efficiency

uses and misuses of derivatives.

Derivatives as we know are risky sources of investments, and there a number of lessons that one can learn from the incident of Amaranth. Before making an investment (esp. in sector fund) it is important to analyze the performance of the sector relating to the profits and losses, during the past few years. A monthly sector analysis reveals that a -24% monthly loss is normal and the monthly volatility of the energy strategies was around 12% (Till, 2006), therefore due consideration should be made by investors before investing in such an industry.

The second factor that fund managers should consider is of marketability or liquidity, which is the ease with which the contracts can be sold into the market again. The exchange traded futures market of natural gas contracts is way smaller than the over-the-counter natural gas positions. This should put the question in investor's minds that in case the market of natural gas declines so how will they sell their contracts and liquidate their position. The strategy of Amaranth did not include an 'exit' strategy. The following case of MotherRock also proves this point.

UNIT - II

FUTURE AND FORWARD MARKET

Forward contracts

Introduction of forward contracts

- Difference with spot contracts
- In over-the-counter market
- Long & short position
- On foreign exchange
- Payoffs from forward contracts
- Forward prices and delivery prices

Forward contracts

- Forward contract is relatively a simple derivative. **It is an agreement to buy or sell an asset at a certain future time for a certain price.**

- It can be contrasted with a spot contract, which is an agreement to buy or sell an asset today.

Forward contracts

- A forward contract is traded in the over-the-counter market—usually between two financial institutions or between a financial institution and one of its clients.

Forward contracts

- One of the parties to a forward contract assumes a long position and agrees to buy the underlying asset on a certain specified future date for a certain specified price.
- The other party assumes a short position and agrees to sell the asset on the same date for the same price.

Forward contracts

- Forward contracts on foreign exchange are **very popular**, **and can be used to hedge foreign currency risk.**

Payoffs from forward contracts

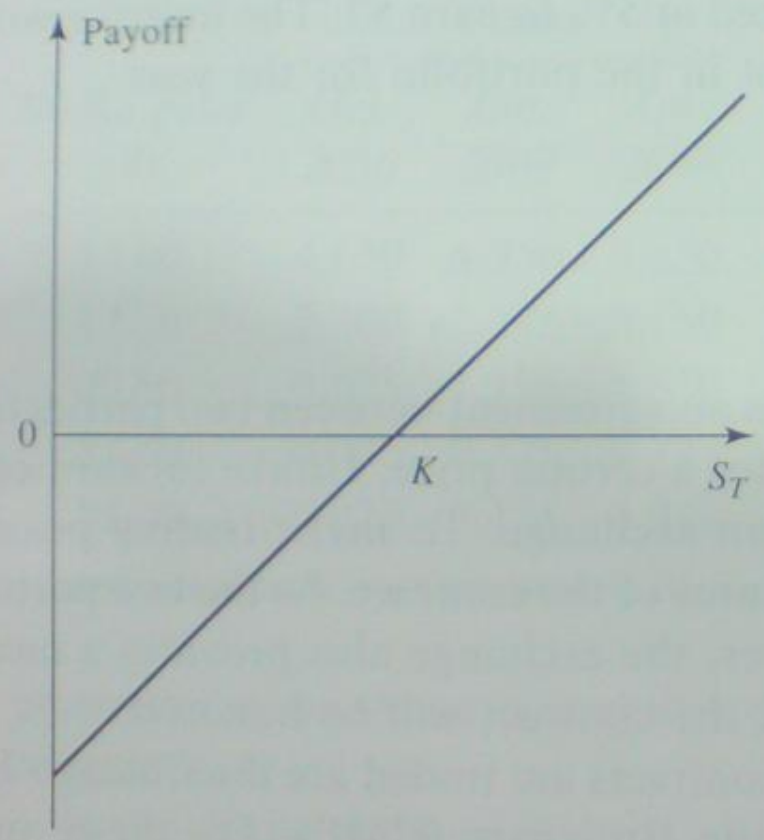
- The payoff from a **long position** in a forward contract on one unit of an asset is

  S - K

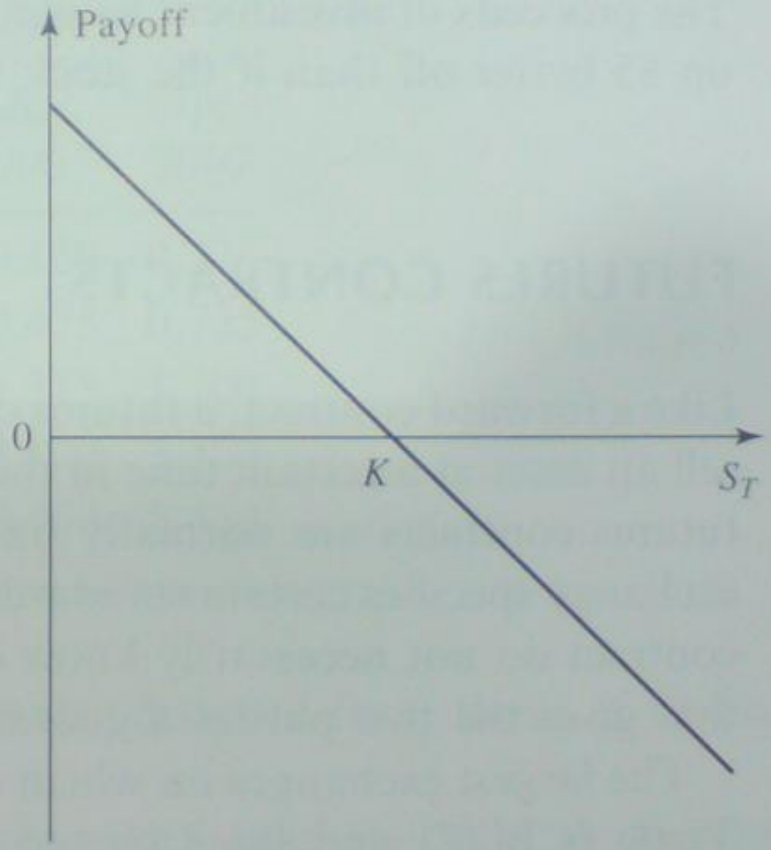
- The payoff from a **short position** in a forward contract on one unit of an asset is

  K - S

Figure 1.2 Payoffs from forward contracts: (a) long position, (b) short position. Delivery price = K; price of asset at contract maturity = S_T.



(a)

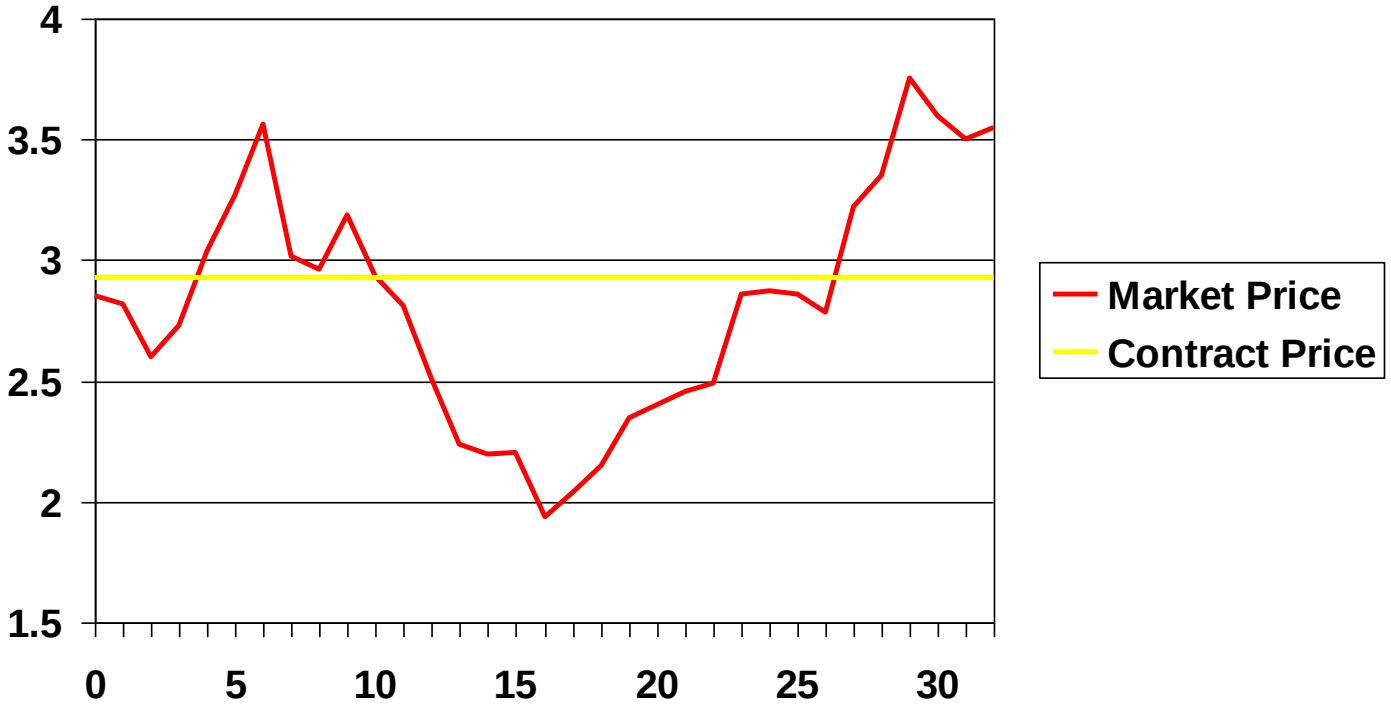


(b)

Futures Contracts

- A futures contract is an **obligation** to buy/sell a specific quantity of a specific commodity at a future date for a predetermined price.
  - The buyer of the future (long position) is required to purchase the commodity
  - The seller of the future (short position) is required to deliver the commodity
- For example, A July wheat future obligates the buyer to purchase 5,000 bushels (FND 6/28, LTD 7/12) for a price of 293 cents/bushel between 6/28 – 7/12.

Futures Contract



- In this example, the long position earns a profit of $.58 per bushel times 5,000 bushels equal $2,900. Note that the short position loses $2,900.

Types of Futures

Currencies	Agriculture	Metals & Energy	Financial
British Pound	Lumber	Copper	Treasuries
Euro	Milk	Gold	LIBOR
Japanese Yen	Cocoa	Silver	Municipal Index
Canadian Dollar	Coffee	Platinum	S&P 500
Mexican Peso	Sugar	Oil	DJIA
	Cotton	Natural Gas	Nikkei
	Wheat		
	Cattle		
	Soybeans		

Hedging Risk With Futures

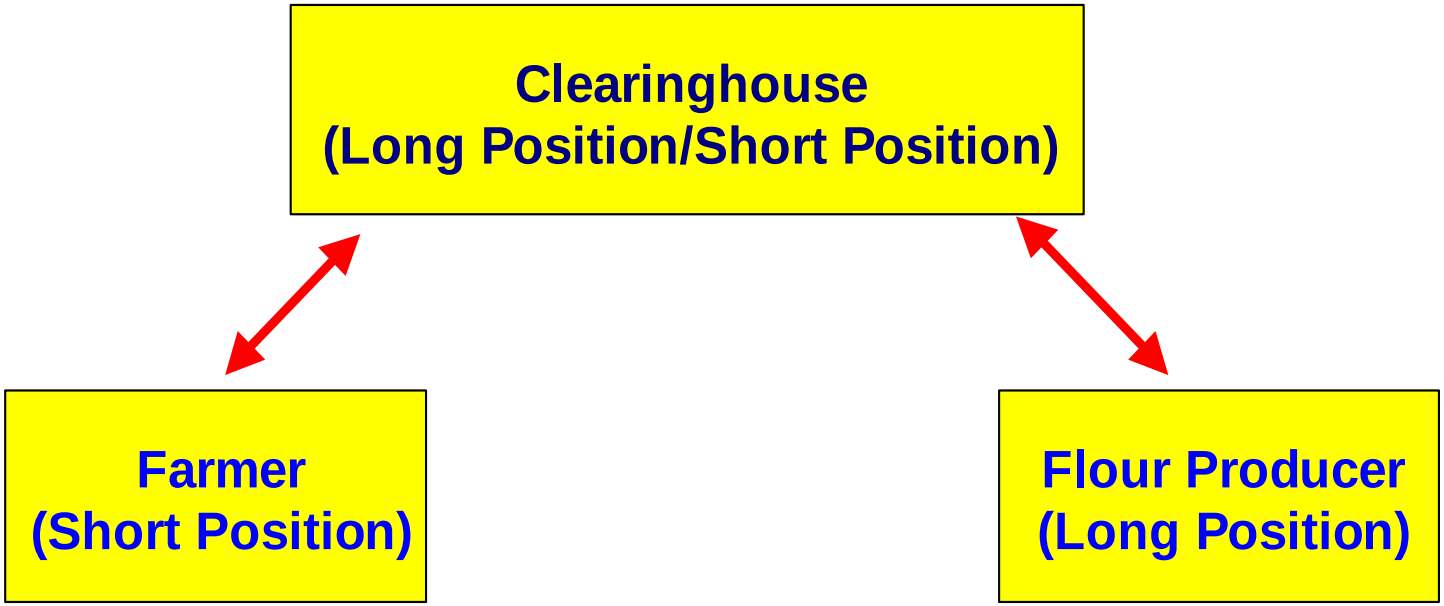
- Suppose you are a wheat farmer, your income is strongly tied to the price of wheat
- Specifically, you are concerned about falling wheat prices
- Therefore, you would like to take a short position in wheat futures

Who will take the long position?

- A flour producer would use wheat as an input to production. Therefore a flour producer might be concerned about rising wheat prices.
- To hedge this risk, the flour producer would want to take a long position in wheat futures

The dealers place orders with their pit traders, who strike a deal.

Once the deal is made, the deal is sent to the clearinghouse, who will act as the middleman



Why is a middleman required?

- Recall that, unlike stocks or bonds, derivatives have future obligations attached to them. The clearinghouse is just an efficient way to insure compliance with the terms of the contract.

Settlement day

- The wheat future requires delivery/purchase of wheat upon expiration. This, however, rarely (if ever) actually happens.
- If the commodity is actually “delivered”, its simply a question of identifying ownership.
- The most common procedure would be a canceling out of the contract by issuing an identical contract of equal size, but opposite position at the current spot price.
- Upon settlement, the profit would be (F-S) for the farmer, and (S-F) for the flour producer.

Hedging Interest Rate Risk

- Suppose that you have purchased a 10 year T-Bond with a face value of $100,000. What risks do you face? How can you hedge that risk?
- You bond price will fall if interest rates rise. Therefore, you would want to take a short position in an interest rate future.
- What type of future should you sell?

Suppose you hedge with 13 Week T-Bill Futures

- For every 1% rise in interest rates, you T-Bond drops by approximately $7,500 in value (10 yr Treasuries have a duration of approximately 7.5)
- If you take a short position in T-Bill futures (the standard size is $1,000,000). For every 1% increase in interest rates, you would earn $2,500 (90 day T-Bills have a duration of .25). Therefore, you would need to buy 3 contracts.
- Further, this T-Bill hedge only protects you from interest rate risk – not yield curve risk.
- Note that your ratio of futures to forwards is 30:1. This is no coincidence!

What should the futures price be?

- As a first pass, remember that no one should expect to make profits in the market. Therefore, the future's price should equal the expected future spot price; $F = E(S')$
- However, it is also reasonable to believe that because futures are being used to hedge risk, the buyers/sellers would be willing to pay a premium for that hedge.
- In the wheat example, the farmer should be willing to pay a future price below the future spot price ($F<E(S)$) while the flour producer should be willing to pay a price higher that the future spot price ($F>E(S)$)
- Modern portfolio theory assumes that fluctuating commodity prices represent a source of systematic risk to financial portfolios. Therefore, because futures can alleviate this risk, they should sell at a discount.

Pricing Futures

- To price a future its important to recognize that there are several ways to generate a given cash flow. Any two methods that generate the same cash flow should have the same cost!

Currency Futures

- Suppose that an October 2005 contract for Euros costs $1.25 per Euro.
  - By going long on this contract, you can buy Euro in one year for $1.25 apiece. How else can you acquire Euro in one year at a fixed price with no money up front?
  - Borrow money today to buy a Euro denominated asset.

Index/Commodity Futures

- Suppose an October S&P 500 index future was selling for $1,150 (This future allows you to buy one share of the index).
  - Alternatively, suppose that you borrowed money today to buy a bond that would pay out enough to purchase a share of the index with certainty next year.

mechanics of future markets hedging strategies

Futures exchanges offer contracts on commodities. These contracts offer producers and consumers alike a mechanism, a futures contract, with which to hedge future production or consumption.

- **Speculators:** Speculators enter the futures market when they anticipate prices are going to change
- **Hedgers:** Hedgers use the futures markets to avoid risk

using futures, determination of forward and future prices

pricing of futures and forwards. When we started the module on “Financial Markets and Products,” we introduced you to the concept of forwards and futures, both of which are contracts to sell or purchase an asset on a future date. In this session, we will discuss how to find the value of these contracts. We will apply the concept of arbitrage in finding the value of the forward.

the concept of absence of arbitrage in efficient markets; i.e., similar assets cannot be sold at different prices. Otherwise, the arbitrageurs will sell the higher priced asset and buy the cheaper one at the same time and earn instantaneous riskless profit. We have also introduced the concept of time value of money in the previous session.

A futures contract is nothing more than a standard forward contract. Therefore, the determinants of the value of either type of contract is the same, so the following discussion will focus on futures

UNIT - III

BASIC OPTION STRATEGIES

Options

An option is a contract written by a seller that conveys to the buyer the right — but not the obligation — to buy (in the case of a call option) or to sell (in the case of a put option) a particular asset, at a particular price (Strike price / Exercise price) in future. In return for granting the option, the seller collects a payment (the premium) from the buyer. Exchangetraded options form an important class of options which have standardized contract features and trade on public exchanges, facilitating trading among large number of investors. They provide settlement guarantee by the Clearing Corporation thereby reducing counterparty risk. Options can be used for hedging, taking a view on the future direction of the market, for arbitrage or for implementing strategies which can help in generating income for investors under various market conditions.

- **Index options**: These options have the index as the underlying. In India, they have a European style settlement. Eg. Nifty options, Mini Nifty options etc. ·
- **Stock options**: Stock options are options on individual stocks. A stock option contract gives the holder the right to buy or sell the underlying shares at the specified price. They have an American style settlement. ·
- **Buyer of an option**: The buyer of an option is the one who by paying the option premium buys the right but not the obligation to exercise his option on the seller/writer.
- **Writer / seller of an option**: The writer / seller of a call/put option is the one who receives the option premium and is thereby obliged to sell/buy the asset if the buyer exercises on him. ·
- **Call option**: A call option gives the holder the right but not the obligation to buy an asset by a certain date for a certain price. · Put option: A put option gives the holder the right but not the obligation to sell an asset by a certain date for a certain price. ·
- **Option price/premium**: Option price is the price which the option buyer pays to the option seller. It is also referred to as the option premium.

distinguish between options and futures

- The investor may instead decide to obtain a futures contract on gold.
- options and futures is the size of the underlying position
- The premium is the maximum that a purchaser of an option can lose.
- contract holder can realize gains also by going to the market and taking the opposite position.
- Generally, the underlying position is much larger for futures contracts

structure of options market

- **structure of option market**. ... **Option** is a contract between two parties in which one party has the right but not obligation to do something, usually to buy or sell some underlying asset.
- The ***trading-driver*** process of ***listed*** options is the same as in the case of listed futures
- An option is an investment alternative among various alternative available in the world of investment.

principles of option pricing.

Option Pricing Principles

We've just been introduced to real call and put options and now understand how to interpret their prices when looking at quotes. But did you notice in Table 1-1 that some options are more expensive than others? Why is that? And is there a pattern we should understand? This chapter takes you through some of the most important pricing principles of options. Understanding these principles is essential for mastering option strategies.

The same thought process occurs in the options markets. For example, both the $32.50 call and the $35 call in Table 2-1 allow the trader to buy 100 shares of eBay, so there are absolutely no differences in what those two coupons allow you to buy. However, the $32.50 allows you to buy the 100 shares for less money. Traders realize the benefit in paying $32.50 rather than $35, so they will compete in the market for that coupon. It is a more desirable coupon, so traders and investors will bid its price higher than the $35 coupon. The same process happens all the way up the line. Each successively lower strike is bid to a higher price. Or conversely, each higher strike is bid lower than the strike below it. When you get into strategies, there will be times when you need to figure out which call option is more valuable.

Option pricing models

- **Lognormal distribution**
- **Volatility**
- **Implied volatility**
- **Equally weighted historical volatility**
- **Exponentially weighted historical volatility**
- **Volatility forecasting**
- **Risk-neutral valuation**

advanced option strategies,

- **Moving on to the Modified Butterfly**
- the unique construction of this trade.
- Trading volatility using various strategies including Butterflies, and Condors.
- The seller of an options contract is called the ‘options writer

UNIT - IV

COMMODITY MARKET DERIVATIVES

Commodity

- A **commodity** is anything for which there is demand, but which is supplied without qualitative differentiation across a markets.

- They are things of value, of uniform quality, that are produced in large quantities by many different producers; the items from each different producer are considered equivalent.

Global classification of commodities

- Precious Metals: Gold, Silver, Platinum, etc.
- Other Metals: Nickel, Aluminum, Copper, Zinc, etc.
- Agro-Based Commodities: Wheat, Rice, Corn, Cotton, Oils, Oilseeds, etc.
- Soft Commodities: Coffee, Cocoa, Sugar, etc.
- Petrochemicals: High Density Polyethylene, Polypropylene.
- Energy: Crude Oil, Natural Gas, Gasoline, etc.

Rare metals

- The following metals are not, at present (2008), traded on any exchange, such as the London Metal Exchange (LME), and, therefore, no spot or futures market, where producers, consumers and traders can fix an official or settlement price exists for these metals.The only price information that is available globally is published by, among others, the London Metal Bulletin and is based on information from producers, consumers and traders. Germanium, Cadmium, Cobalt, Chromium, Magnesium, Manganese, Molybdenum, Silicon, Rhodium, Selenium, Titanium, Vanadium, Wolframite, Niobium, Lithium, Indium, Gallium, Tantalum, Tellurium, and Beryllium.

Agricultural products

- The following Agricultural Products are not, at present (2008), traded on any exchange, and, therefore, no spot or futures market where producers, consumers and traders can fix an official or settlement price exists for these minerals. Generally the only price information that is available is based on information from producers, consumers and traders.

- Fresh Flowers, Cut Flowers, Melons, Lemons, Tung Oil, Gum Arabic, Pine Oil, Xanthan, Milk, Tomatoes, Grapes, Eggs, Potatoes, and Figs.

Commodities – An Alternate Asset Class

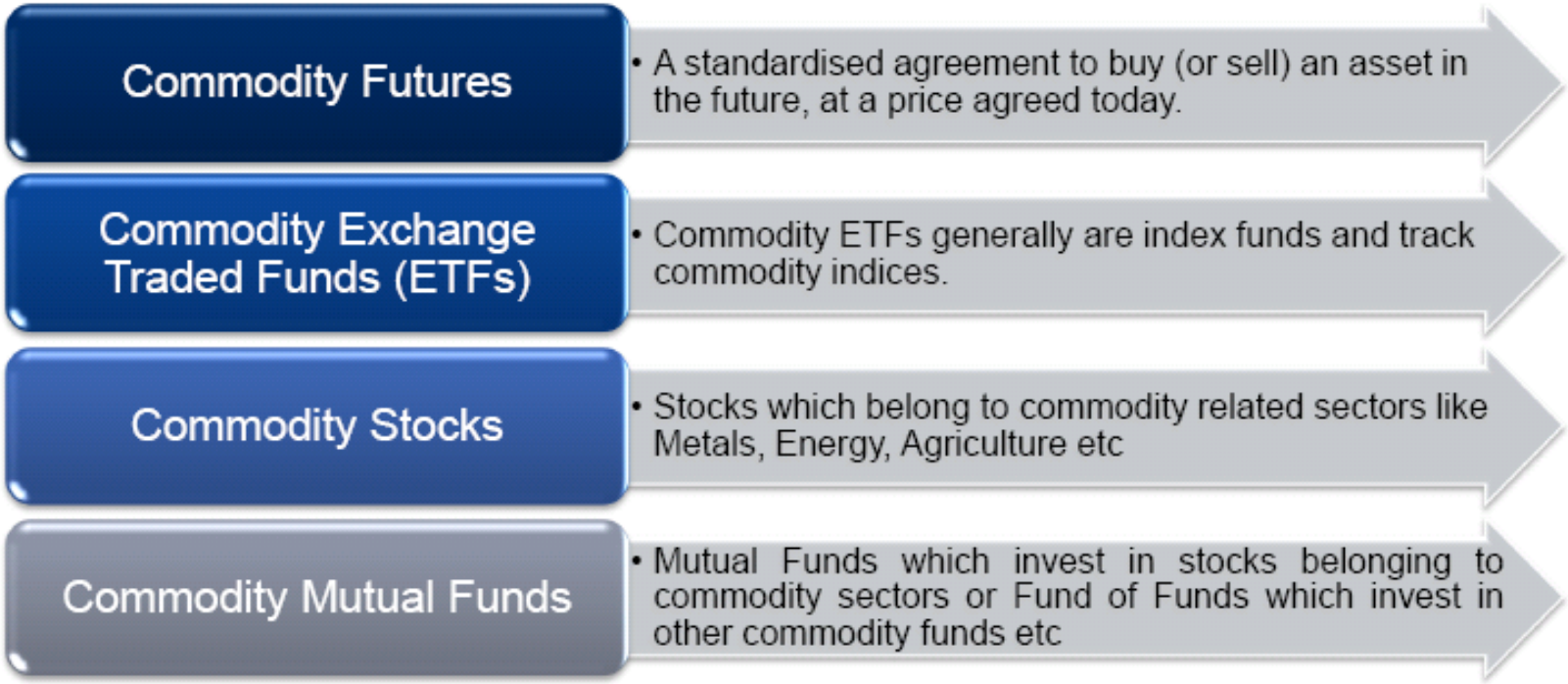
- Returns are independent of other asset classes
- Low correlation with other asset classes
- Its returns cannot be replicated with combination of other asset classes
- Positively correlated with inflation whereas bonds & equities are negatively
- correlated
- Have independent risk/return profile

Commodity market

- Commodity market is a place where trading in commodities takes place. These are the markets where raw and primary products are exchanged.

- These raw commodities are traded on regulated commodity exchanges, in which they are bought and sold in standardized contracts. It is similar to an equity market, but instead of buying or selling shares one buys or sells commodities.

How to Trade in Commodities



- Investor exposure till date has been through futures trading
- Commodity exposure through platforms like mutual funds is now gaining ground

Commodity Exchange

- An entity, usually an incorporated non-profit association, that determines and enforces rules and procedures for the trading of commodities and related investments, such as commodity futures.
- Commodities exchange also refers to the physical center where trading takes place
- 18 existing commodity exchanges in India offering domestic contracts in 8 commodities and 2 exchanges that have permission to conduct trading in international (USD denominated) contracts.
- The two most important **commodity exchanges** in **India are;**
- 1)Multi-**Commodity** Exchange of **India** Limited (MCX),
- 2) National Multi-**Commodity** & Derivatives Exchange of **India** Limited (NCDEX)

National Commodity and Derivatives Exchange Limited - NCDEX

This is an online multi-commodity exchange that is promoted in 2003 and professionally managed by the following:

- ICICI Bank Limited - ICICI Bank
- Life Insurance Corporation of India – LIC
- NABARD
- National Stock Exchange of India Limited – NSE
- Punjab National Bank – PNB
- CRISIL Limited
- Indian Farmers Fertiliser Cooperative Limited
- Canara Bank

Multi Commodity Exchange of India Ltd - MCX

- MCX is an independent multi commodity exchange, headquartered in Mumbai, 2003.

- MCX is promoted by Financial Technologies.

- It is recognized by the government for conducting the following in the area of commodities futures and options:
  - facilitating online trading
  - clearing
  - settlement operations

MCX offers connects to the following;

- Producers and Processors
- Traders
- Corporate house
- Regional trading centers
- Importers
- Exporters
- Co-operatives
- Industry Associations and institutions

Product at MCX: For Example

- Bullion
- Spices
- Fiber
- Cereals
- Plantations
- pulses
- Oil & Oil Seeds
- Energy
- Petrochemicals
- Metals

Commodity Trading

Spot trading

Spot trading is any transaction where delivery either takes place immediately, or if there is a minimum lag, due to technical constraints, between the trade and delivery. Commodities constitute the only spot markets which have existed nearly throughout the history of humankind.

FORWARD CONTRACT

- A forward contract is an agreement between two parties (counterparties) for the delivery of a physical asset (e.g., oil or gold) at a certain time in the future for a certain price that is fixed at the inception of the contract.

- Forward contracts can be customized to accommodate any commodity, in any quantity, for delivery at any point in the future, at any place.

Future Contracts

- Futures contracts are highly uniform and well-specified commitments for a carefully described good (quantity and quality of the good) to be delivered at a certain time and place (acceptable delivery date) and in a certain manner (method for closing the contract) and the permissible price fluctuations are specified (minimum and maximum daily price changes).

- At present 22 Exchanges are recognized/registered for forward/ futures trading in commodities.

- Under the Forward Contracts (Regulation) Act, 1952, forward trading in commodities notified under section 15 of the Act can be conducted only on the Exchanges, which are granted recognition by the Central Government (Department of Consumer Affairs, Ministry of Consumer Affairs, Food and Public Distribution).

Other Features of Future…

- All the commodities are not suitable for futures trading and for conducting futures trading. For being suitable for futures trading the market for commodity should be competitive, i.e., there should be large demand for and supply of the commodity. The commodity should have long shelf-life and be capable of standardization and gradation.

- Price discovery is done through two popular methods. The fundamental analysis is concerned with basic supply and demand information, such as, weather patterns, carryover supplies, relevant policies of the Government and agricultural reports. Technical analysis includes analysis of movement of prices in the past.

Forward Vs. Futures

COMPARISON	FORWARD	FUTURES
Trade on organized exchanges	No	Yes
Use standardized contract terms	No	Yes
Use associate clearinghouses to guarantee contract fulfillment	No	Yes
Require margin payments and daily settlements	No	Yes
Close easily	No	Yes
Regulated by identifiable agencies	No	Yes
Any quantity	Yes	No
Any product	Yes	No

The Major Actors in commodity market

- **Speculator**

  A trader who enters the futures market in pursuit of profit, accepting risk in the endeavor.
- **Hedger**

  A Trader who enters the futures market to reduce some pre-existing risk exposure.
- **Broker**

  An Individual or firm acting as an intermediary by conveying customers' trade instructions. Account executives or floor brokers are examples of brokers.

Regulatory Issues

- Forward Markets Commission is a regulatory body for commodity futures/ forward trade in India.
- The regulation is needed to create competitive conditions. In the absence of regulation, unscrupulous participants could use these leveraged contracts for manipulating prices.
- To ensure that the market has appropriate risk management system. In the absence of such a system, a major default could create a chain reaction.
- The financial crisis in a futures market can create systematic risk.
- To ensure fairness and transparency in trading, clearing, settlement and management of the exchange so as to protect and promote the interest of various stakeholders.

Functions of the Forward Markets Commission

- FMC advises Central Government in respect of grant of recognition or withdrawal of recognition of any association.
- It keeps forward markets under observation and takes such action in relation to them as it may consider necessary, in exercise of powers assign to it.
- It collects & publishes information relating to trading conditions in respect of goods including information relating to demand, supply and prices and submit to the Government periodical reports and working of forward markets in commodities.
- It makes recommendations for improving the organization and working of forward markets.
- It undertakes inspection of books of accounts and other documents of recognized/registered associations.

Risk Factors

- Commodity markets are also susceptible to volatility.
  - Changing demand supply dynamics cause variation in commodity prices.

- Other factors too can impact commodity prices
  - Climatic aspects like floods, droughts etc
  - Industry related factors e.g. acreage and yields etc
  - Geopolitical considerations etc

There is no suggestion that commodity markets are indifferent to market risks vis-a-vis any other asset class, however the existence of effective risk management and risk modeling capabilities will help to mitigate possible risks

UNIT - V

SWAPS

An Introduction to Swaps

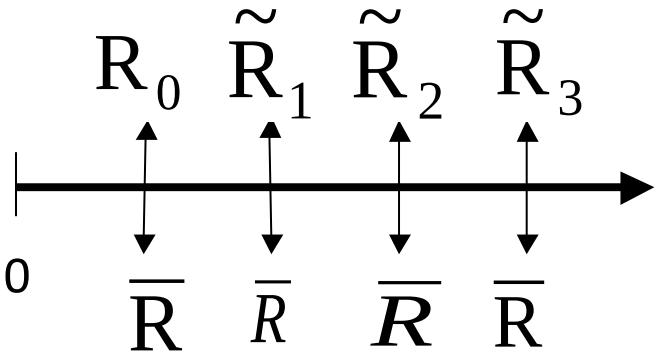
- A swap is an agreement between counter-parties to exchange cash flows at specified future times according to pre-specified conditions.
- A swap is equivalent to a coupon-bearing asset plus a coupon-bearing liability. The coupons might be fixed or floating.
- A swap is equivalent to a portfolio, or strip, of forward contracts--each with a different maturity date, and each with the same forward price.

A “Plain Vanilla” Interest Rate Swap, I.

- Party B agrees to pay a fixed payment and receive a floating payment, from counter-party A.
- Party B is the fixed rate payer-floating rate receiver (the “pay-fixed” party).
- Party A is the fixed rate receiver-floating rate payer (the “receive-fixed” party).
- Typically, there is no initial exchange of principal (i.e., no cash flow at the initiation of the swap).

A "Plain Vanilla" Interest Rate Swap, II.

- On 3/1/02, an agreement is struck wherein for the next 3 years, every six months, company B receives from company A, a payment on a notional principal of **$100 million**, based on **6-mo LIBOR.** Company B makes a fixed payment on the same notional principal to company A, based on a rate of **5%** per annum.
- Define $\overline{R}$ as the **fixed rate**.
- Define $\tilde{R}$ as the **variable (floating) rate**.
- Define NP as the **notional principal**.
- Note that 6-month LIBOR at origination is $R_0 = 4.20\%$.
- The next two slides illustrate the cash flows.



Multiply each "R" by NP times #days between payments over 360

(or use a 365-day year)

- Each actual payment ("difference check") equals the difference between the interest rates times NP times #days between payments over 360, or #days/365.
- The time t variable cash flow is typically based on the time t-1 floating interest rate.
- Thus, the first floating cash flow, based on the rate, R_0, is known: it is 4.20%.
- All subsequent floating cash flows are random variables as of time zero (but always known one period in advance).

The Cash Flows to Company B

		---------Millions of Dollars---------		
Date	LIBOR Rate	*FLOATING* Cash Flow	*FIXED* Cash Flow	Net Cash Flow
Mar.1, 2002	4.2%			
Sept. 1, 2002	4.6%	+2.10	–2.50	–0.40
Mar.1, 2003	5.1%	+2.30	–2.50	–0.20
Sept. 1, 2003	5.5%	+2.55	–2.50	+0.05
Mar.1, 2004	5.6%	+2.75	–2.50	+0.25
Sept. 1, 2004	4.9%	+2.80	–2.50	+0.30
Mar.1, 2005	4.4%	+2.45	–2.50	- 0.05

A Closer Look at the Cash Flows on September 1, 2002

- Floating Payment:
  - Based on the 6-month LIBOR rate that existed on March 1, 2002: 4.20%.
  - ($100,000,000)(0.042)(1/2) = +$2,100,000.
- Fixed Payment:
  - Based on 5% rate.
  - ($100,000,000)(0.05)(1/2) = -$2,500,000.
- Net Cash Flow: -$400,000.

Quoting Plain Vanilla Swaps

- Typically, the floating index, e.g. LIBOR, is bought or sold “flat.”
- If you buy LIBOR (pay-fixed), you pay a spread over the most recently issued Treasury with the same maturity as the swap (the asked swap spread).
- If you receive fixed (sell LIBOR) then you receive the Treasury rate plus the bid swap spread, which is smaller than the asked swap spread.
- Example:
  - For a 5-year swap, a dealer might quote 20 (bid) and 24 (asked).
  - Suppose the yield midpoint of the most recently issued 5-year T-note is 5.40%.
  - Then, the pay-fixed party will pay 5.64%, and receive LIBOR.

Typical Uses of an Interest Rate Swap

- To convert a liability from:
  - a fixed rate to floating rate.
  - a floating rate to fixed rate.

- To convert an investment (asset) from:
  - a fixed rate to floating rate.
  - a floating rate to fixed rate.

Other Interest Rate Swap Structures

- Off market swaps: The fixed rate may be away from the market; an initial payment will have to be negotiated.
- Amortizing swap: varying NP according to a predetermined schedule.
- Index amortizing swap: The NP, or term of the swap, varies according to some randomly changing interest rate index.
- Basis swap: The two interest rates both float (e.g., LIBOR and the prime rate; or 2-year Treasury rate and 10-year Treasury rate).
- Forward swap: The first cash flow takes place in the "far" future, "long" after the terms of the swap have been negotiated.

Currency Swaps

- There are four types of basic currency swaps:
  - fixed for fixed.
  - fixed for floating.
  - floating for fixed.
  - floating for floating.

- N.B.: It is the *interest* rates that are fixed or floating.

- Typically, **the NP is exchanged** at the swap's initiation and termination dates.

Typical Uses of a Currency Swap

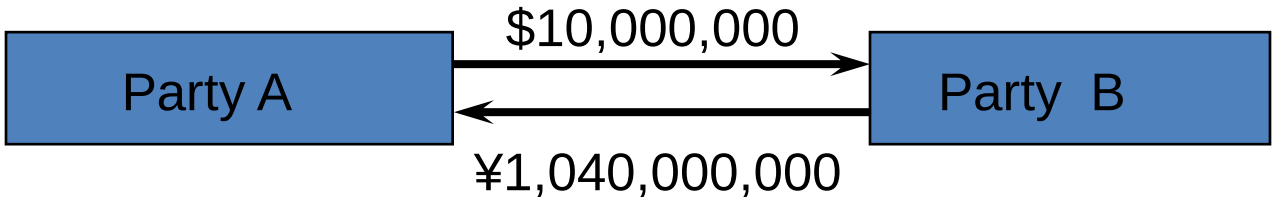
- To convert a liability in one currency into a liability in another currency.
- To convert an investment (asset) in one currency to an investment in another currency.

An Example of a Fixed for Fixed Currency Swap

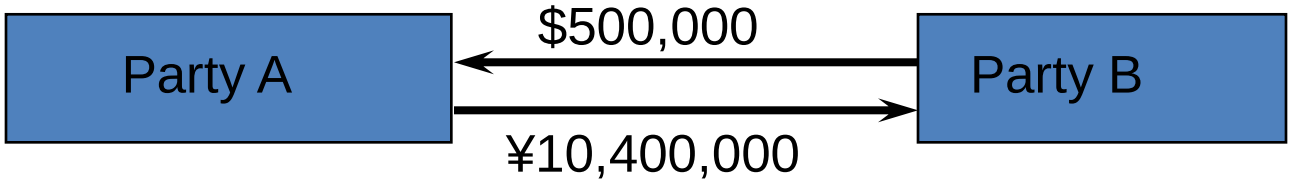
- An agreement to pay 1% on a Japanese Yen principal of ¥1,040,000,000 and receive 5% on a US dollar principal of $10,000,000 every year for 3 years.
- ***In a currency swap, unlike in an interest rate swap, the principal is exchanged at the beginning and at the end of the swap.***
- Note that in currency swaps, the direction of the cash flows at time zero is the opposite of the direction of the subsequent cash flows in the swap (see the next slide).

Cash Flows in a Fixed-for-Fixed Currency Swap

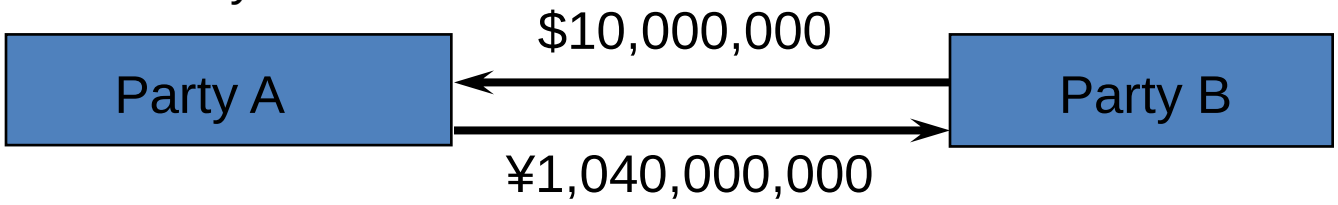
At origination:



At each annual settlement date:

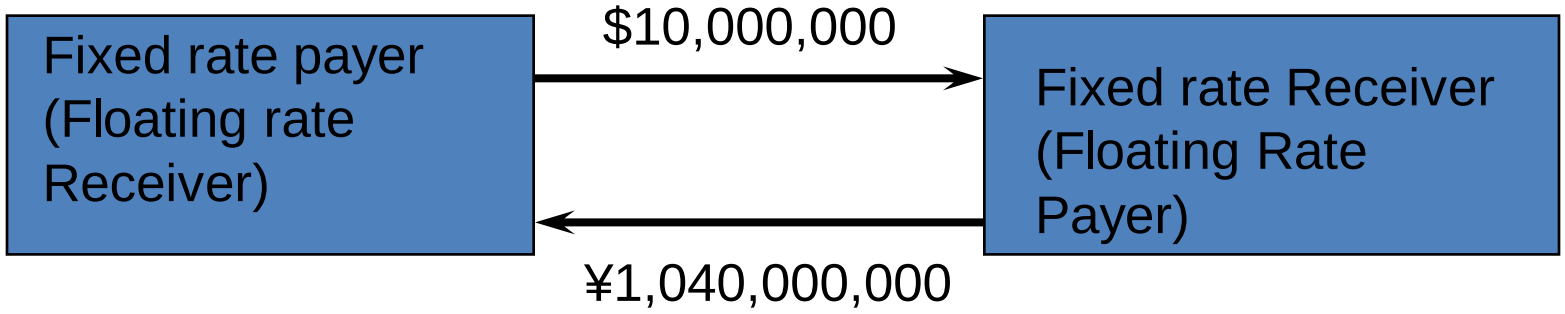


At maturity:



Cash Flows in a Fixed-for-Floating Currency Swap

- On the origination date:
  - The fixed rate payer pays $10,000,000 to the fixed rate receiver.
  - The fixed rate receiver pays ¥1,040,000,000 to the fixed rate payer.



Calculating Subsequent Cash Flows for this Fixed-for-Floating Currency Swap

- Tenor is three years. NP_1 = ¥1,040,000,000 yen, and r_1 = 1% fixed in yen. NP_2 = $10,000,000, and r_2 = 6 month $-LIBOR (floating). Settlement dates are every 6 months, beginning 6 months hence.
- On the origination date, 6 month LIBOR is 5.5%.
- Assume that subsequently, 6 mo. LIBOR is:

Time	6 mo. LIBOR
0.5	5.25%
1.0	5.50%
1.5	6.00%
2.0	6.20%
2.5	6.44%

All Cash Flows for this Fixed-for-Floating Currency Swap

6-mo. time	LIBOR	Fixed rate Payment	Floating rate Payment
0.0	5.50%	$10MM	¥1,040MM
0.5	5.25%	¥5.2MM	$275,000
1.0	5.50%	¥5.2MM	$262,500[1]
1.5	6.00%	¥5.2MM	$275,000
2.0	6.20%	¥5.2MM	$300,000
2.5	6.44%	¥5.2MM	$310,000
3.0	----	¥5.2MM	$322,000
		¥1,040MM	$10MM

N.B. The time t floating cash flow is determined using the time t-1 floating rate.

[1] Time 1.0 floating rate payment is (0.0525/2)($10,000,000) = $262,500.

Credit Risk: Currency Swaps

- Note that there is greater credit risk with a currency swap when there will be a final exchange of principal.

- This means that there is a higher probability of a large buildup in value, giving one of the counter-parties (the one who is losing) the incentive to default.

Credit Risk

- No credit risk exists when a swap is first created.
- The credit risk in a swap is greater when there is an exchange of principal amounts at termination.
- Only the winning party (for whom the swap is an asset) faces credit risk. This risk is the risk that the counter-party will default.
- Many vehicles exist to manage credit risk:
  - Collateral (or collateral triggers)
  - Netting agreements
  - Credit derivatives
  - Marking to market

Other Currency Swap Structures

- See the different interest rate swap structures presented earlier. They all apply to currency swaps, too.

- Index differential swaps, or “diff” swaps:
  - The cash flows are based on two floating rates in different countries, but they are applied to the NP of *one* of the currencies.
  - For example, pay €-based LIBOR, and receive $-based LIBOR, on a NP of $20MM. All payments are in $.

Commodity Swaps

- Equivalent to a strip of forward contracts on a commodity.
- Define NP in terms of the commodity; e.g., 10,000 oz. of gold.
- The NP is not exchanged.
- Define P_{fixed} as the fixed price.
- Payments are made by comparing the actual price of the commodity on the settlement date (or an average price over the period, or the actual price one period earlier) to the fixed price.

Commodity Swaps: an Example, I.

- A gold mining firm wants to fix the price it will receive for the gold it will mine over the next 3 years.
- A gold user wants to fix the price it will have to pay for the gold it needs for the next 3 years.
- NP = 10,000 oz.
- P_{fixed} = $320/oz.
- Settlement is semi-annual, based on average price of gold during the past six months.

Commodity Swaps: an Example, II.

Subsequently:

Time	Avg. gold price during past pd.	Producer **pays (-)** or **receives (+)**
0.5	$305	**+$150,000**
1.0	$330	**-$100,000**
1.5	$368	**-$480,000**
2.0	$402	**-$820,000**
2.5	$348	**-$280,000**
3.0	$300	**+$200,000**

Pricing and Valuing Swaps

- Pricing a Swap: Calculating the “fair fixed rate.”
- The idea: Calculate a fixed rate whereby market participants are indifferent between paying (receiving) this fixed rate over time or paying (receiving) a rate that can fluctuate over time.
- This is accomplished by setting the value of the swap equal to zero at origination.
- This is achieved when the present value of the two (expected) cash flow streams equal each other.

Pricing and Valuing Swaps, II.

- Valuing a Swap: Because a swap is equivalent to an asset and a liability, one can just value each of them to determine the value of the swap at any moment in time.

- At origination, a swap will have zero value.

- However, “off-market” swaps will not have a zero value at origination.

Pricing a Plain Vanilla Interest Rate Swap, I.

- Define r(0,t) as the spot interest rate for a zero coupon bond maturing at time t.
- Define $r(t_1,t_2)$ as the forward interest rate from time t_1 until time t_2.
- Assume the zero (spot) term structure is:

  r(0,1) = 5%, r(0,2) = 6%, r(0,3) = 7.5%.
- Therefore the forward rates are:

  fr(1,2) = 7.01%; and fr(2,3) = 10.564%.
- These forward rates should exist in the FRA and futures markets.

Pricing a Plain Vanilla Interest Rate Swap, II.

- Now consider a swap with a tenor of 3 years.
- The floating rate is the one-year LIBOR.
- Settlement is yearly.
- What is the "fair" fixed rate? (I.e., what is the "price" of a swap under these conditions?
- ***Let the forward rates be the expected future spot rates.***
- Arbitrarily set NP = $100. Assume (for convenience) that NP is exchanged.
- Thus, the "expected" floating rate cash flows are:

$CF_1 = (0.05)(100) = 5$
$CF_2 = (0.0701)(100) = 7.01$
$CF_3 = (0.1056)(100) = 10.564$
$CF_3 = 100$

Pricing a Plain Vanilla Interest Rate Swap, III.

- Value these expected cash flows at the appropriate discount rates: the spot zero coupon interest rates:

$$\frac{5}{1.05}+\frac{7.01}{(1.06)^2}+\frac{10.564}{(1.075)^3}+\frac{100}{(1.075)^3}=100$$

- An important lesson: The the value of the floating rate side of the swap equals its NP, ***immediately after a floating payment has been made.***

Pricing a Plain Vanilla Interest Rate Swap, IV.

- Because the value of a swap at origination is set to zero, the fixed rate payments must satisfy:

$$\frac{A}{(1.05)}+\frac{A}{(1.06)^2}+\frac{A}{(1.075)^3}+\frac{100}{(1.075)^3}=100$$

$$A\left\{\frac{1}{(1.05)}+\frac{1}{(1.06)^2}+\frac{1}{(1.075)^3}\right\}=100-80.496$$

$$A\{2.6473\}=19.504$$

$$A=7.367$$

Pricing a Plain Vanilla Interest Rate Swap, V.

- Thus, the swap dealer might quote 7.35% to a fixed-rate receiver, and 7.39% to a fixed-rate payer.
- Equivalently, if the yield on the most recently issued 3-year T-note is 7.05%, the quoted swap spreads would be 30 bp (bid) to 34 bp (asked).
- If interest rates change, the value of the swap will change.
- However, the valuation method remains the same.

Valuing a Swap after Origination, I.

- If prices or rates subsequently change, the value of the swap will change. It will become an asset (+ value) for one party, and a liability (- value) for the other (the party who could default).
- But, the valuation method (compute the PV of the contracted fixed cash flows and of the expected variable cash flows) remains the same.
- Also, one can make use of the fact that PV(floating CF) = NP, immediately after a CF has been swapped.

Valuing a Swap after Origination, II.

- Consider the previous plain vanilla interest rate swap example.
- Suppose that 3 months after the origination date, the yield curve flattens at 7%.
- The **next** floating cash flow is known to be 5.
- Immediately after this payment is paid, PV(remaining floating payments) = NP = 100.

Valuing a Swap after Origination, III.

$$V_{floating} = \frac{5}{1.07^{0.75}} + \frac{100}{1.07^{0.75}} = 99.805.$$

$$\left(V_{floating} = PV(\text{Next Payment}) + PV(NP)\right)$$

$$\text{So, after 3 - months, } V_{floating} \text{ has decreased.}$$

$$V_{fixed} = \frac{7.367}{1.07^{0.75}} + \frac{7.367}{1.07^{1.75}} + \frac{107.367}{1.07^{2.75}} = 102.685.$$

$$\text{So, after 3 - months, } V_{fixed} \text{ has increased.}$$

- The swap's value is \$2.88, per \$100 of NP. (102.685 – 99.805).
- That is, one would have to pay \$2.88 today to eliminate this swap. Who pays whom?

Valuing a Currency Swap after Origination

- Consider the currency swap from Chapter 11, with an original tenor of 4 years. NP_1 = \$10MM, and NP_2 = 1,040MM yen. r_1 = 5%, and r_2 = 1%.
- Suppose that 3 months after the swap origination, the Japanese interest rate rises to 2%, U.S. interest rates remain unchanged, and the spot exchange rate becomes ¥102/\$.
- The value of the domestic payments remains at \$10 million.

Valuing a Swap after Origination, IV.

- The value of the yen payments becomes:

$$V_Y = \frac{\text{Y10.4MM}}{(1.02)^{0.75}} + \frac{\text{Y10.4MM}}{(1.02)^{1.75}} + \frac{\text{Y10.4MM}}{(1.02)^{2.75}} + \frac{\text{Y1050.4MM}}{(1.02)^{3.75}} = \text{Y1005.36MM}$$

$$\text{In terms of } \$ = (\$0.009804/\text{Y})(\text{Y1005.36}) = \$9.8565\text{MM}$$

$$V = \$9{,}856{,}500 - \$10{,}000{,}000 = -\$143{,}500$$

- For the pay-$ / receive ¥ party, the value of the swap is -$143,500.

Pricing a Commodity Swap, I.

- Here, we will find the fixed price for a fixed-for-floating gold price swap, assuming settlement will be every six months, beginning four months from today.
- Also, the term will be 22 months and the floating price will be the spot price of gold on each settlement date.
- Today, gold futures prices are:

Months to Next Delivery Date	Gold Futures Price
4	409.20
10	415.10
16	420.40
22	425.80

Pricing a Commodity Swap, II.

- Assume the appropriate zeros, with time expressed in years, are:

  r(0,0.33)=4.0%, r(0,0.83)=4.2%,

  r(0,1.33)=4.5%, r(0,1.83)=4.7%

- The swap consists of an asset and a liability. One side of the swap is an agreement to buy gold.

- Based on the gold futures ‘term structure’, the PV of these expected floating payments is:

Pricing a Commodity Swap, III.

$$\frac{409.20}{(1.04)^{0.33}} + \frac{415.10}{(1.042)^{0.83}} + \frac{420.40}{(1.045)^{1.33}} + \frac{425.80}{(1.047)^{1.83}}$$

$$= 1{,}593.072$$

- The present value of the agreement to sell gold at the fixed price (F) is:

Pricing a Commodity Swap, IV.

$$F\left\{\frac{1}{(1.04)^{0.33}}+\frac{1}{(1.042)^{0.83}}+\frac{1}{(1.045)^{1.33}}+\frac{1}{(1.047)^{1.83}}\right\}=1{,}593.072$$

$$F\{3.816093\}=1{,}593.072$$

$$F = \$417.4615$$

- Thus, the swap dealer will quote to sell fixed at $417.46 plus a profit margin, and to buy fixed at $417.46 minus a profit margin.