

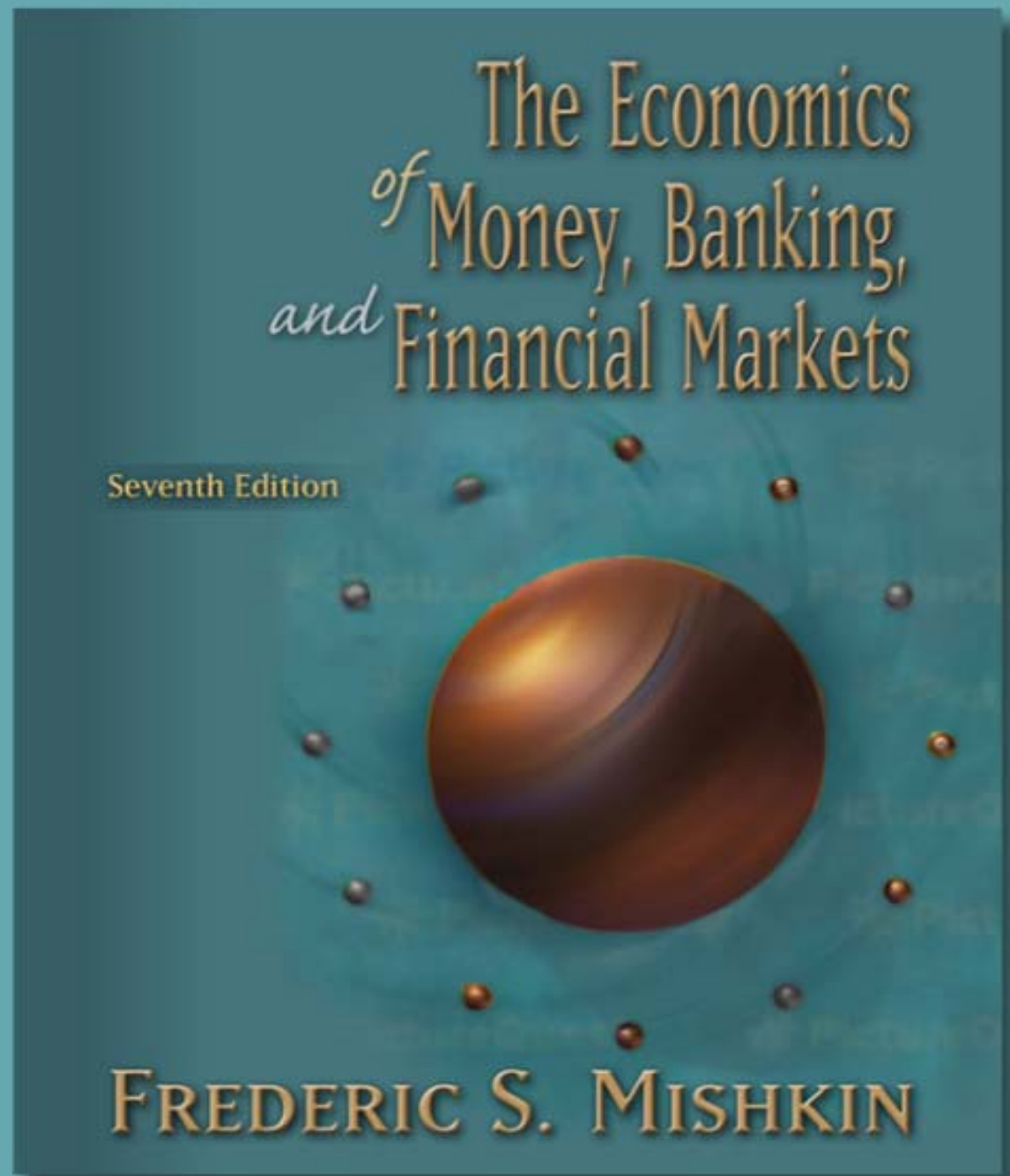
# Essex EC248-2-SP

## Class 9

### Financial Derivatives: Student Presentation

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# Introduction

- **Financial innovation** (F.I.) is the search for innovations in the finance industry by financial institutions ~ stimulated by changes in financial environment.

**2 major** changes have occurred during the previous century causing F. I.

- In 1960's inflation and interest rates both rose sharply & became harder to predict ~ changed the demand conditions for finance products (bonds, etc,) in the finance industry.
- Introduction and improvement of technology, namely the improvement of computers and telecommunications technology ~ changed the supply conditions in the finance industry for finance products.

The rapid developments in technology have resulted in many new financial products and services such as

- **Credit and debit cards**
- **Electronic banking and**
- **Junk bonds**
- **Commercial Paper Market**
- **Securisation**

In response to the change in demand conditions brought about by interest rate volatility in the 1970's and 80's (interest-rate risk).

Financial institutions created:

- **Adjustable-Rate Mortgages** (adjustable-rate loans in general)
- **Financial Derivatives**

Therefore Financial Derivations were created to satisfy the demand for a reduction in interest-rate risk.

Financial derivatives - very effective in reducing risk because they enable firms to **hedge**; that is, engage in a financial transaction that reduces or eliminates risk.

**Hedging risk** – a financial transaction that offsets a long position (when a financial institution has bought an asset; exposes the institution to risk if the returns on the asset are uncertain) by taking an additional short position (when a financial institution has sold an asset that it has agreed to deliver to another party at a future date; also exposes the institution to risk) or vice versa.

There are 4 types of financial derivatives :

- **Interest-Rate Forward Contracts**
- **Financial Futures Contracts and Markets**
- **Options**
- **Interest-Rate Swaps**

# Interest-Rate Forward Contracts (IRFCs)

- Forward contracts are agreements by 2 parties to engage in a financial transaction at a future (forward) point in time.
- Interest-rate forward contracts involve the future sale of a debt instrument and they have several dimensions
- Specifications of the actual debt instrument that will be delivered at a future date
- Amount of debt instrument to be delivered
- Price (interest-rate) on debt instrument when delivered
- Date on which delivery may take place

## **Advantage of IRFCs**

- They're as flexible as the parties involved want them to be. For example Bob's Bank may be able to hedge all the interest-rate risk for the exact security it is holding in its portfolio.

## **Disadvantages of IRFCs**

- It's very hard for Bob's Bank to find another party to make a contract with, due to the specific contract it wants to make, which other parties may not find appealing. Furthermore if Bob's Bank does find a suitable counterparty, Jimbo PLC, it may not get as high a price as it wants because there may not be anyone else to make the deal with. This market suffers a lack of liquidity.
- Subject to default risk. If in a years time interest rates rise so the price of the 8s bonds falls, Jimbo PLC may default of the forward contract because it can buy other bonds at a lower price than the agreed price.
- Due to default risk, adverse selection and moral hazard, there are high costs for firms on areas such as research on their interested counterpart.

Therefore the financial futures market is much larger than interest-rate forward contracts.



# Futures

- A **future contract** is a contract where an agreement is made to buy or sell a commodity at a certain date in the future, at a pre-set price. The future date is called the **delivery date** or **final settlement date**. The pre-set price is called the **futures price**. **Future contracts** were developed as a financial derivative by the Chicago Board of Trade in 1975. An example of **future contracts** are treasury bonds.

- For an example, to get an understanding of the concept of future contracts think of subscribing to SKY or NTL TV. As the buyer, you enter into an agreement with the broadcasting company to receive a specific number of channels at a certain price every month for the next year. This contract made with the cable company is similar to a futures contract, in that you have agreed to receive a product at a future date, with the price and terms for delivery already set. You have secured your price for now and the next year--even if the price of the subscription rises during that time. By entering into this agreement with the broadcasting company, you have reduced your risk of higher prices

- Parties who have bought a futures contract and thereby agreed to buy (take delivery of) the financial asset are said to have taken the ‘long position’ (in the above example the SKY/NTL customer) and parties who have sold a futures contract and thereby agreed to sell (deliver) the financial asset are said to have taken the short position (SKY/NTL).

- The profits and losses of a futures depend on the daily movements of the market for that contract and is calculated on a daily basis. In the case of a bond if interest rates increase the party in the long position (the one who bought the bond) is made worse off where as the party in the short position (the one who sold the bond) just got a better deal. The opposite would happen if the interest rate decreased.

- However, we can offset this loss by hedging the interest risk. This is done by offsetting the long position in these bonds with a short position, so you need to sell the future contracts. The number of contracts to sell for the hedge is calculated by:

$$\frac{\text{Value of the asset}}{\text{Value of each contract}} = \text{No. contracts for hedge}$$

There are two types of hedging:

- Micro hedging (hedging interest rate risk for a specific asset)
- Macro hedging (hedging for an institutions entire portfolio)

- America dominated the trading of financial futures in the early 1980's, but by the 1990's thanks to the development of the Globex, electronic trading platform traders through out the world trade futures even when the exchanges are not officially open.

Futures have been very successful in the financial market, the main reasons for this are:

- Futures contracts are standardised (limit product range to create stability) which makes it more likely that parties can be matched up helping to improve liquidity.
- Once a future is bought or sold it can be traded again allowing continuous trade further helps liquidity.
- With futures it is less likely that someone would corner the market (buying all deliverable securities so that investors in the short position can not obtain from anyone else) because many different securities can be delivered can be delivered so someone aiming to corner would have to buy a very large number of securities to corner.
- Trading of securities are done through clearing houses so problems of adverse selection are reduced for the individual reducing the worry of default risk.

To make sure the clearing houses are financially sound buyers and sellers of future contracts must make an **initial margin** (a deposit that you will be fully refunded when the future contract is liquidated plus/minus any gain/loss occurred over the duration of the contract

At the end of every day the changes in the value of the future contract are added/subtracted from your margin account accordingly.



- In the futures market there is an auction market in which participants buy and sell the commodity/future contracts for delivery on a specified future date. Trading is carried on through in a trading pit with open yelling and hand singles to show the buying and selling of contracts.

The holder of future or forward contract is obliged to trade at the maturity of the contract. Unless the position is closed before maturity the holder must take possession of the commodity, currency or whatever is the subject of the contract, regardless of whether the asset has risen or fallen.

Wouldn't it be nice if we only had to take possession of the asset if it had risen?

The simplest option gives the holder the right to trade in the future at a previously agreed price but takes away the obligation. So if the stock falls, we don't have to buy it after all.

# Options

## A Brief History of Options Markets

- The concept of an option existed in ancient Greece and Rome.
- Options were used by speculators in the tulip craze of seventeenth-century Holland. Tulips bulbs were traded as a speculative commodity by many of the Dutch, with prices reaching 1000 times their true value. Tulip growers sold options which allowed the buyers to profit if prices declined. When prices did fall, the growers went bankrupt without fulfilling the option contracts, giving options a bad name.
- Trading in options was banned in England, especially in the 1930s and from World War II until 1956.
- In the United States, options traded in the streets of Chicago on an illegal basis.
- Stock options, (as we know them today) started to trade in April 1973 on the Chicago Board Options Exchange ( CBOE ). It was then that The Chicago Board Options Exchange ( CBOE ) first created standardized, listed options. Initially there were just calls on 16 stocks. Puts weren't even introduced until 1977.

# “WHAT ARE OPTIONS?”

Everyone has options. When buying a car, we can add more equipment to the automobile that is “optional at extra cost”. In this sense, an option is a choice. Every option is either a call option or a put option.

- **Call option:** a security that gives its owner the right, but not the obligation, to purchase a specified asset for a specified price, known as the exercise price or the strike price.
- **Put option:** a security that gives its owner the right, but not the obligation, to sell a specified asset for a specified price, known as the exercise price or the strike price.

The **owner, or holder**, of an option- who is said to adopt a **long position**- acquires the option by paying a premium (also called the option price) to the **writer**-who is said to adopt a **short position**. If the holder of a call option chooses to exercise the option, the exercise price is paid to the call writer in exchange for the asset. If the holder of a put option chooses to exercise the option, the asset is delivered to the put writer in exchange for the exercise price.

# In Summary

## Call option

- Holder: **may** buy asset for exercise price from writer
- Writer: **must** sell asset for exercise price, at holder's discretion

## Put option

- Holder: **may** sell asset for exercise price to writer
- Writer: **must** buy asset for exercise price, at holder's direction

There are two fundamental kinds of options: the **American option** and the **European option**.

- An **American** option can, by definition be exercised before or at the specified expiry (expiration) date.
- A **European** option can be exercised only at the expiry date, if it is exercised at all.

Both American and European options are traded in financial markets across the world, not just in America and Europe, respectively.

- American options are more common but are more difficult to analyse than European options.

# Terminating an option investment

An option owner has three ways of terminating the contract:

- Allow the option to die, **unexercised**, at the expiry date.
- **Exercise** the option. Exercise occurs at the expiry date for a European option, or any time up to the expiry date for an American option.
- **Offset** the position by selling an identical option before the expiry date. Off-setting is a routine operation for exchange-traded option.

## Notation

**C** = American call option price, or premium

**P** = American put option price, or premium

**c** = European call option price, or premium

**p** = European put option price, or premium

**S** = current price of the underlying asset

**X** = exercise, or strike, price

**T** = expiry date

**t** = current date, so that  $\tau \equiv T-t$  = length of maturity

**r** = rate of interest, assumed to be positive



# An Option Example

Consider an option with a share of K stock as the underlying good.

Assume that today is March 1 ( **$t=1$  March**) and that K shares trade at \$110 ( **$S=\$110$** ). The market, we assume, trades a call option to buy a share of K at \$100 ( **$X=\$100$** ) with this right lasting until August 15 ( **$T=15$  August**) and the price of this option being \$15 ( **$c=\$15$** ). If a trader buys the call option, he pays \$15 and receives the right to purchase a share of K stock by paying an additional \$100, if he so chooses, by August 15. The seller of the option receives \$15, and she promises to sell a share of K for \$100 if the owner of the call chooses to buy before August 15. The premium the seller receives is hers to keep whether or not the owner of the call decides to exercise the option. If the owner of the call exercises his option, he will pay \$100 no matter what the current price of K stock may be. If the owner of the option exercises his option, the seller of the option will receive the \$100 exercise price when she delivers the stock as she promise

**At the same time**, puts will trade on K. Consider a put option with  $X = \$100$  trading on March 1 that also expires on August 15. Assume that the price of the put is  $c = \$5$ . If a trader purchases a put, he pays \$5. In exchange, he receives the right to sell a share of K for \$100 at any time until August 15. The seller of the put receives \$5, and she promises to buy the share of K for \$100 if the owner of the put option chooses to sell before August 15.

- In both the put and call example, the payment by the purchaser is gone forever at the time the option trades. The seller of the option receives the payment and keeps it, whatever the owner of the option decides to do. If the owner of the call exercises his option, then he pays the  $X$  as an additional amount and receives a share. Likewise, if the owner of the put exercises his option, then he surrenders the share and receives the  $X$  as an additional amount. The owner of the option may choose never to exercise. In that case, the option will expire on August 15. The payment the seller receives is hers to keep whether or not the owner exercises. If the owner chooses not to exercise, the seller has a profit equal to the premium received and does not have to perform under the terms of the option contract.

# In and out of the money

- During the life of an option (before it expires or it exercised), the underlying asset price may differ from the exercise price,  $S \neq X$ , stipulated in the option contract.
- It means that there is profit or loss from the immediate exercise of an option. An option may be **in the money, out of the money, at the money.**

## Call option

A call option is **in the money** if the stock price exceeds the exercise price.

$$S > X$$

For example, a call option with  $X = \$100$  on a stock trading at  $S = \$110$  is \$10 in the money.

A call option is **out of the money** if the stock price is less than the exercise price.  $S < X$

For example, if the stock price is at  $S = \$110$  and the exercise price on a call is  $X = \$115$ , the call is \$5 out of the money.

A call option is **at the money** if the stock price equals (or is very near to) the exercise price.  $S = X$

## Put option

A put option is **in the money** if the stock price is below the exercise price.

$$S < X$$

As an example, consider a put option with  $X = \$70$  on a stock that is worth  $S = \$60$ . The put is \$10 in the money, because the immediate exercise of the put would give a \$10 cash inflow. Similarly, if the put on the same stock had an exercise price of  $X = \$55$ ,  $S > X$  the put would be \$5 **out of the money**.

If the put had  $X = S$ , the put would be **at the money**.

# Why Trade Options?

Options trading today is more popular than ever before. For the investor, options serve a number of important roles. Trading the option instead of the underlying stock can offer a number of advantages.

- Many investors trade options to speculate on the price movements of the underlying stock.
- Call options are always cheaper than the underlying stock, so it takes less money to trade calls.
- Put options are cheaper than the underlying goods.
- Many investors prefer to trade options rather than stocks in order to save transaction costs, to avoid tax exposure, and to avoid stock market restrictions

# Similarities and Differences between Futures and Options Markets

The option contracts can be easily **standardised**, they offer **anonymity** and **guaranteed** by exchange authorities. These 3 features are also common in futures contracts.

While there are similarities between exchange-traded options and futures contract, there are also some important differences.

- An option owner-an investor with a long position- can simply allow the option to die, unexercised. The same opportunity is not available to an investor with a long position in a futures contract, who must either offset the position before maturity or take delivery (and pay for) the asset on which the contract is written.
- Options provide an alternative type of hedging and speculative contract for a trader.
- Options have different characteristics than futures contracts - **include a premium** in their price that does not exist for a futures contract. However options have a limited loss equal to the initial price of the option.
- Market participants must choose the specific market that is consistent with their goals and purposes.

# SWAPS

## A brief History of Swaps

The origins of the swap market can be traced to the late 1970s, when currency traders developed currency swaps as a technique to avoid British controls on the movement of foreign currency. The first interest rate swap occurred in 1981 in an agreement between IBM and the World Bank. Since that time, the market has grown rapidly.



# WHAT ARE SWAPS?

A **swap** is an **agreement** between two or more parties to exchange a sequence of cash flows over a period in the future.

- For example, Party A might agree to pay a **fixed rate of interest** on \$1million each year for five years to Party B. In return, Party B might pay a **floating rate of interest** on \$1 million each year for five years. The parties that agree to the swap are known as **counterparties**. The cash flows that the counterparties make are generally tied to the value of debt instruments or to the value of foreign currencies. Therefore, the two basic kinds of swaps are **interest rate swaps** and **currency swaps**.

**Plain vanilla swap** - the basic known interest rate swap.

- In a plain vanilla interest rate swap, one counterparty agrees to pay a sequence of fixed rate interest payments and to receive a sequence of floating rate interest payments. The swap agreement **specifies a time** over which the periodic interest payments will be made. The amount of the periodic interest payments is called **notional principal**.

# Characteristics of the Swaps Market - by having a review of Futures and Options Markets Features

- Futures and exchange-traded options generally have a fairly short horizon, which is often much shorter than the risk horizon that businesses face.
- The swap counterparties choose the exact maturity that they need, rather than having to fit their needs to the offerings available on an exchange-this flexibility allows the counterparties to deal with **very long horizons**.
- Futures markets trade highly standardized contracts, and the options traded on exchanges also have highly specified contract terms that cannot be altered.
- Swap agreements can meet the specific needs of the counterparties. They can select the dollar amount that they wish to swap, **without regard to some fixed contract terms**.
- On futures and options exchanges, major financial institutions are readily identifiable.
- In the swaps only the counterparties know that the swap takes place-**they afford privacy**
- Futures and options exchanges are subject to considerable government regulation.
- The swaps market has virtually **no government regulation**.

- The need and ability to be able to exchange one type of interest payment for another is fundamental to the running of many businesses. This has put swaps among the most liquid of financial contracts. This enormous liquidity makes swaps such an important product that one has to be very careful in their pricing.
- In fact, swaps are so liquid that you do not price them in any theoretical way, to do so would be highly dangerous.

# Summary

- Interest rate forward contracts are agreements to sell a debt instrument at a future (forward) point in time which can be used to hedge interest rate risk. The main advantage of forward contracts is that they are flexible. The disadvantages to forward contracts are that they are subject to default risk and the market for them is not very liquid.
- Financial Future contracts are similar to forwards in that they specify a debt instrument that must be delivered by one party to another on a stated future date and they can be used to by financial institution to hedge against interest rate risk. However, unlike forwards futures are not subject to default risk and the futures market is more liquid than the forwards market.

- Option contracts give the purchaser the right to buy (**call option**) or sell (**put option**) at the exercise price within a specified period of time. The profits of options contracts do not always grow by the same amount for a given change in the price of the underlying financial instrument. The value of the options contract is negatively related to the exercise price for **call options** and positively related to the exercise price for **put options**. Financial institutions use futures options to hedge interest rate risk in a similar fashion to the way they use financial futures and forwards. Futures may be preferred for macro hedges because they have fewer accounting problems than financial futures.
- Interest rate swaps are a financial contract that allow one party to exchange a set of interest payments for another set of interest payments that are owned by another party. Interest rate swaps often involve intermediaries such as large commercial and investment banks that make a market in swaps. The biggest advantage that interest rate swaps have is that they can be written for very long periods of time.