BACHELOR OF FINANCIAL ENGINEERING

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STA 2421: DERIVATIVE SECURITIES

Topic 1: Overview of Derivative Securities

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STA 2421: DERIVATIVE SECURITIES

Topic 1: Overview of Derivative Securities

1) Overview of derivative securities
2) Types of derivatives: forwards, futures, options and swaps;
3) Role, structure and regulation of global derivatives markets;
4) Derivatives market terminology;
5) Key market participants and roles;
6) The purposes of derivative markets; and
7) Criticisms of derivative markets

Overview of Derivative Securities

A **derivative security** or a **derivative** is a financial contract that derives its value from an underlying asset's price, such as a stock or a commodity, or even from an underlying financial index like an interest rate.

A derivative can both reduce risk, by providing insurance (which, in financial parlance,

is referred to as *hedging*), and magnify risk, by speculating on future events.

Derivatives provide unique and different ways of investing and managing wealth that ordinary securities do not.

Overview of Derivative Securities

Derivatives can be created on any asset, event, or outcome, which is called the **underlying**.

The underlying can be a real asset, such as wheat or gold, or a financial asset, such as the share of a company. The underlying can also be a broad market index, such as the S&P 500 Index or the FTSE 100 Index.

Overview of Derivative Securities

The underlying can be an outcome, such as a day with temperatures under or over a specified temperature (also known as heating and cooling days), or an event, such as bankruptcy.

Derivatives can be used to manage risks associated with the underlying, but they may also result in increased risk exposure for the other party to the contract.

Overview of Derivative Securities

Imagine a wheat farmer who wants to reduce some of the risks of farming. The farmer anticipates having at least 50,000 Kg of wheat available for sale in mid-October, six months from now.

Wheat is currently trading in the market at Shs 9.00 per Kg, which is the **spot price**.

The farmer has no way of knowing what the market price of wheat will be in six months.

Overview of Derivative Securities

The farmer finds a cereal producer that needs wheat and is willing to contract to buy 50,000 Kgs of wheat at a price of Shs 8.50 per Kg in six months.

The contract provides a **hedge** for both the farmer and the cereal producer.

A hedge is an action that reduces uncertainty or risk.

Overview of Derivative Securities

But what if the farmer cannot find someone who actually needs the wheat? The farmer might still find a counterparty that is willing to enter into a contract to buy the wheat in the future at an agreed on price.

This counterparty may anticipate being able to sell the wheat at a higher price in the market than the price agreed on with the farmer.

Overview of Derivative Securities

This counterparty may be called a **speculator.**

This counterparty is not hedging risk but is instead taking on risk in anticipation of earning a return.

But there is no guarantee of a return.

Even if the price in the market is lower than the price agreed on with the farmer, the counterparty has to buy the wheat at the agreed on price and then may have to sell it at a loss.

Overview of Derivative Securities

Derivatives allow companies and investors to manage future risks related to raw material prices, product prices, interest rates, exchange rates, and even uncontrollable factors, such as weather.

They also allow investors to gain exposure to underlying assets while committing much less capital and incurring lower transaction costs than if they had invested directly in the assets.

Key Terms of Derivatives Contracts

There are four main types of derivatives contracts:

1) Forward contracts (forwards),
2) Futures contracts (futures),
3) Option contracts (options), and
4) Swap contracts (swaps).

Each of these will be discussed in the following sections.

Key Terms of Derivatives Contracts

All derivatives contracts specify four key terms: the

(1) Underlying,

(2) Size and price,

(3) Expiration date, and

(4) Settlement.

Key Terms: 1. Underlying

Derivatives are constructed based on an underlying, which is specified in the contract.

Originally, all derivatives were based only on tangible assets, but now some contracts are based on outcomes.

In essence, underlying refers to **the security or asset that must be delivered when a contract or warrant is** exercised.

Examples of underlyings include the following:

Key Terms: 1. Underlying

- Agricultural products (such as wheat, rice, soybeans, cotton, butter, and milk)
- Livestock (such as hogs and cattle)
- Currencies
- Interest rates
- Individual shares and equity indices
- Bond indices
- Economic factors (such as the inflation rate)
- Natural resources (such as crude oil, natural gas, gold, silver, and timber)
- Weather-related outcomes (such as heating or cooling days)
- Other products (such as electricity or fertilisers)

Key Terms: 1. Underlying

A derivative's underlying must be clearly defined because quality can vary.

For example, crude oil is classified by specific attributes, such as its American Petroleum Institute (API) gravity, specific gravity, and sulphur content; Brent crude oil, light sweet crude oil, and crude oil are different underlyings.

Similarly, there is a difference between Black Sea Wheat, Soft Red Winter Wheat No. 1 and No.2, and KC Hard Red Winter Wheat No. 1 and No. 2.

Key Terms: 2. Size and price

The contract must also specify size and price.

The size is the amount of the underlying to be exchanged. The price is what the underlying will be purchased or sold for under the terms of the contract.

The price specified in the contract may be called the **exercise price** or the **strike price**.

Note that the price specified in the contract is not the current or spot price for the underlying but a price that is good for future delivery.

Key Terms: 3. Expiration Date

All derivatives have a finite life; each contract specifies a date on which the contract ends, called the expiration date.

Key Terms: 4. Settlement

Settlement describes how a contract is satisfied at expiration.

Some contracts require settlement by physical delivery of the underlying and other contracts allow for or even require cash settlement.

If physical delivery to settle is possible, the contract will specify delivery location(s).

Contracts with underlying outcomes, such as heating or cooling days, cannot be settled through physical delivery and must be settled in cash. In practice, most derivatives contracts are settled in cash.

Main Types of Derivatives Contracts: Forwards & Futures

Forwards and futures involve obligations in the future on the part of both parties to the contract.

Forward and futures contracts are sometimes termed forward commitments or bilateral contracts because both parties have a commitment in the future.

Bilateral contracts expose each party to the risk that the other party will not fulfil the contractual agreement.

Main Types of Derivatives Contracts: 1. Forwards

A **forward contract** is an agreement between two parties in which one party agrees to buy from the seller an underlying at a later date for a price established at the start of the contract.

The future date can be in one month, in one year, in five years, or at any other specified date.

Investors primarily use forward contracts to lock in the price of an underlying and to gain certainty about future financial outcomes.

Forwards Contracts: Example 1.

The contract between the farmer and cereal producer for 50,000 Kgs of wheat in mid-October, six months from now, at Shs. 8.50 per Kgs is a forward contract.

The underlying is wheat, the size is 50,000 Kgs, the exercise price is Shs. 8.50 per Kg, the expiration date is mid-October, and settlement will be with physical delivery. In October, the farmer will deliver the wheat to the cereal producer and receive Shs. 8.50 per Kg.

Main Types of Derivatives Contracts: 1. Forwards

By entering into the forward contract, the farmer knows the wheat will sell and has eliminated uncertainty about how much money will be received for the wheat.

The cereal producer knows that wheat will be available and has eliminated uncertainty about how much the wheat will cost.

Main Types of Derivatives Contracts: 1. Forwards

Forward contracts transact in the over-the-counter market—that is, the agreement is made directly between two parties, a buyer and a seller—although a dealer may help arrange the agreement.

The risk that the other party to the contract will not fulfil its contractual obligations is called **counterparty risk**.

To reduce counterparty risk, the parties to a forward contract evaluate the default risk of the other party before entering into a contract.

Main Types of Derivatives Contracts: 1. Forwards

If the risk of default is significant, the parties may not agree to a forward contract. Or one or both parties may require a **performance bond**.

A performance bond is a guarantee, usually provided by a third party, such as an insurance company, to ensure payment in case a party fails to fulfil its contractual obligations (defaults).

As an alternative to a performance bond, collateral may be requested. Collateral refers to pledged assets. That is, if one party cannot fulfil its contractual obligations, the other party can keep the collateral as compensation.

Main Types of Derivatives Contracts: 1. Forwards

No payment on the contract is required by either party prior to delivery. At expiration, forward contracts usually settle with physical delivery.

At settlement, one party will lose and the other party will gain relative to the spot price at the expiration date—this price variance also serves to increase counterparty risk.

Example 2 uses the forward contract between the farmer and the cereal producer to illustrate how one party's gains on a forward contract are the other party's losses.

Forwards Contracts: Example 2.

Gains and losses on a forward contract

If at expiration of the forward contract, the price in the market for a Kg. of wheat is Shs.8.50 per Kg., neither the farmer nor the cereal producer would be better off transacting in the spot market, but neither lost anything.

Forwards Contracts: Example 2.

Gains and losses on a forward contract

But if at expiration of the forward contract, the price in the market for a Kg. of wheat is Shs.9.00 per Kg., the farmer loses Shs.0.50 per Kg. relative to the spot price.

In other words, the farmer could have sold the wheat for Shs.9.00 per Kg. rather than the Shs.8.50 per Kg. agreed on in the forward contract. The cereal producer gains Shs.0.50 per Kg. relative to the spot price because the producer only pays Shs.8.50 per Kg. rather than the Shs.9.00 spot price.

Forwards Contracts: Example 2.

Gains and losses on a forward contract

Similarly, if at expiration of the forward contract the price in the market for a Kg. of wheat is Shs.8.00 per Kg., the farmer gains and the cereal producer loses Shs.0.50 per Kg. relative to the spot price.

Forwards Contracts: Example 2.

Given the possibility of losing money relative to the future spot price, why do the farmer and cereal producer enter into the forward contract?

Because each is more concerned about eliminating the uncertainty related to the sale price and purchase price of wheat in six months, which is valuable in making investment and production decisions.

This certainty is more important to them than winning or losing relative to the future spot price.

Main Types of Derivatives Contracts: 1. Forwards Exchange Contracts

A forward exchange contract is a contract made now for the purchase or sale of a quantity of currency in exchange for another currency, for settlement at a future date, and at a rate of exchange that is fixed in the contract.

A **forward contract** therefore fixes in advance the rate at which a specified quantity of currency will be bought and sold.

Purpose of Forwards Exchange Contracts

The purpose of a forward contract is to fix an exchange rate now for the settlement of a transaction at a future date. This removes uncertainty about what the exchange rate will be at the future date.

Currency risk is a two-way risk. By arranging a forward contract, a company can hedge against the risk of an adverse movement in the spot exchange rate up to the date of settlement, but at the same time it loses the opportunity to gain from a favourable movement in the spot rate.

Purpose of Forwards Exchange Contracts

Forward contracts can be arranged for settlement up to several months ahead, or possibly as much as one year ahead, depending on the nature of the money markets in the two currencies.

They may therefore be used to manage exposures to transaction risk, but cannot be used as a hedge against currency risk in the long term.

Forwards Exchange Rates

Forward exchange rates are determined by the current spot rate and differences in interest rates between the two currencies.

A forward exchange rate may be higher or lower than the spot rate.

When a currency is more expensive forward than spot, it is quoted forward 'at a premium' to the spot rate.

When a currency is cheaper forward than spot, it is quoted forward 'at a discount' to the spot rate.

Forwards Exchange Rates

The forward rate can be calculated today without making any estimates of future exchange rates. **Future exchange rates** depend largely on future events and will often turn out to be very different from the forward rate.

However, the forward rate is probably an **unbiased predictor of the expected value of the future exchange rate**, based on the information available today. It is also likely that the spot rate will move in the direction indicated by the forward rate.

Forwards Exchange Contracts

Forward exchange contracts are legally binding contracts.

They hedge against transaction exposure by allowing the importer or exporter to arrange for a bank to sell or buy a quantity of foreign currency at a future date, at a **rate of exchange determined** when the **forward contract is made**.

Forwards Exchange Contracts

The trader will know in advance either how much local currency they will receive (if they are selling foreign currency to the bank) or how much local currency they must pay (if they are buying foreign currency from the bank).

Forward contracts are very popular with small companies as a method of hedging currency risk and taking away uncertainty about the exchange rate.

The current spot price is irrelevant to the outcome of a forward contract.

Forwards Exchange Contracts

A **forward exchange contract** is defined as:

(a) An immediately firm and binding contract, eg between a bank and its customer

(b) For the purchase or sale of a specified quantity of a stated foreign currency

(c) At a rate of exchange fixed at the time the contract is made

(d) For performance (delivery of the currency and payment for it) at a future time which is agreed when making the contract (This future time will be either a specified date, or any time between two specified dates.)

Main Types of Derivatives Contracts: 2. Futures

What if the farmer could not identify a party that wanted to be on the other side of the contract?

What if the farmer could not identify a party that wanted to be on the other side of the contract? Futures markets may provide the solution.

Main Types of Derivatives Contracts: 2. Futures

A **futures contract** is similar to a forward contract in that it is an agreement that obligates the seller, at a specified future date, to deliver to the buyer a specified underlying in exchange for the specified futures price.

The buyer of the contract is obligated to take delivery of the underlying, and the seller of the contract is obligated to deliver the underlying, although settlement may be with cash.

Main Types of Derivatives Contracts: 2. Futures

The main difference is that futures contracts are standardised contracts that trade on exchanges. The buyers and sellers do not necessarily know who is on the other side of the contract.

Because the contracts are traded on exchanges, they are liquid and it is possible for a buyer or seller to close out a position by taking the opposite side.

In other words, the buyer of a contract can sell the same contract and the seller of a contract can buy the same contract.

Main Types of Derivatives Contracts: 2. Futures

The presence of an exchange as an intermediary between buyers and sellers helps reduce counterparty risk.

Counterparty risk cannot be eliminated completely, however, because there is always a remote chance that the exchange fails to fulfil its own contractual obligations.

To protect itself against one of the parties defaulting, the exchange typically requires that parties to the contract deposit funds as collateral. The depositing of funds as collateral is called **posting margin.**

Main Types of Derivatives Contracts: 2. Futures

The amount deposited on the day that the transaction occurs is called the **initial margin**.

The initial margin should be sufficient to protect the exchange against movements in the underlying's price.

The exchange sets the margin amount depending on the underlying's price volatility—the greater the underlying's price volatility, the higher the margin.

Main Types of Derivatives Contracts: 2. Futures

Another way of reducing the counterparty risk for futures contracts is by **marking to market** daily.

Marking to market means that profits or losses on futures contracts are settled at the end of every business day, which has the effect of resetting the contract price and cash flows to buyers and sellers.

Main Types of Derivatives Contracts: 2. Futures

At the end of each day, the exchange establishes a settlement price based on the closing trades and determines the difference between the current settlement price and the previous day's settlement price.

The buyer's and seller's margin accounts are adjusted to reflect the change in settlement price and whether it was to their advantage or disadvantage. Marking to market continues until the contract expires.

Main Types of Derivatives Contracts: 2. Futures

If at any time the balance in an account falls below a pre-specified amount, the exchange will ask the customer to submit additional funds.

If the customer does not do so, the futures position is closed.

Daily marking to market reduces counterparty risk and administrative overhead for the exchange. The result is enhanced trading, increased liquidity, and reduced transaction costs on futures contracts.

Main Types of Derivatives Contracts: 2. Futures

Standardised terms of futures contracts include the underlying; size, price, and expiration date of the contract; and settlement.

A number of different standardised contracts may trade for an underlying on an exchange, but standardisation of futures contracts reduces the number of contract types available for the same underlying.

Typically, each of the contracts is the same with respect not only to the underlying but also to size and settlement.

Exercise price and expiration date may vary among contracts.

Main Types of Derivatives Contracts: 2. Futures

Specifying the underlying in a futures contract includes defining the quality of the asset so that the buyer and seller have little room for confusion regarding pricing and physical delivery.

Certain deviations from the default quality standards are permitted with adjustments in price.

In addition, the contract specifies the delivery locations and the period within which delivery must be made. The size of a futures contract is set by the exchange to ensure a tradable quantity of adequate value.

Main Types of Derivatives Contracts: 2. Futures

The other terms may vary across the different contracts. Futures typically expire every quarter, usually on the third Wednesday of March, June, September, and December. In addition, many end-of-month futures are available. Standardised contracts may exist that only differ on the specified price.

A contract's net initial value to each party should be zero; cash may be paid by one of the parties to enter into the contract depending on how the exercise price compares with the current settlement price.

An example describing futures contracts is presented next.

Example: Currency Futures

Currency futures are standardised contracts for the sale or purchase at a set future date of a set quantity of currency.

Currency futures can be used to hedge currency risk in the same way as forward contracts. Futures are exchange-traded instruments whereas forward contracts are over the counter transactions. Forward contracts are used much more extensively than currency futures.

A futures market is an exchange-traded market for the purchase or sale of a standard quantity of an underlying item, such as currencies, commodities or shares, for settlement at a future date and at an agreed price.

Example: Currency Futures

A future's price may be different from the spot price, and this difference is the **basis**.

Basis = Spot price – Futures price

One **tick** is the smallest measured movement in the contract price. For currency futures this is a movement in the fourth decimal place.

Market traders will compute gains or losses on their futures positions by reference to the number of ticks by which the contract price has moved.

Class Exercise: Currency Futures

A US company buys goods worth €720,000 from a German company payable in 30 days. The US company wants to hedge against the € strengthening against the dollar.

Current spot is $0.9215 – $0.9221 per €1 and the € futures rate is $0.9245 per €1.

The standard size of a three-month € futures contract is €125,000.

In 30 days' time the spot is $0.9345 – $0.9351 per €1.

Closing futures price will be $0.9367 per €1.

Required:

Evaluate the hedge.

Solution to Class Exercise: Currency Futures

Step 1 **Setup**

(a) **Which contract? :** We assume that the three month contract is the best available.

(b) **Type of contract:** We need to buy € or sell $. As the futures contract is in €, we need to buy futures.

(c) **Number of contracts:** $\frac{720{,}000}{125{,}000} = 5.76$, say 6 contracts

(d) **Tick size:** Minimum price movement*contract size = 0.0001*125,000 = $12.50

Solution to Class Exercise: Currency Futures

Step 2 **Closing futures price** We're told it will be 0.9367.

Step 3 **Hedge outcome**

(a) Outcome in futures market		
Opening futures price	0.9245	Buy at low price
Closing futures price	0.9367	Sell at high price
Movement in ticks	122 ticks	Profit
Futures profit/loss	122 * $12.50*6 contracts	= $9,150

Solution to Class Exercise: Currency Futures

Step 3 **Hedge outcome**

(b) **Net outcome**		
		$
Spot market payment	(720,000 * 0.9351 $/£)	673,272
Futures market profit		(9,150)
		664,122

Distinctions between Forwards and Futures

Forwards and futures differ in how they trade:

The flexibility of key terms in the contract,

Liquidity,

Counterparty risk,

Transaction costs,

Timing of cash flows, and

Settlement.

Distinctions between Forwards and Futures

1. Trading and Flexibility of Terms. Forward contracts transact in the over-the-counter market and terms are customised according to the contracting parties' needs.

Futures contracts trade on exchanges. Each exchange typically sets the terms of the contracts that trade on it.

Futures contracts are **standardised** regardless of buyers' and sellers' specific needs. As a result, the expiration date or contract size may not match that desired by the buyer or seller of the futures contract.

Distinctions between Forwards and Futures

1. Trading and Flexibility of Terms (continued)

For hedgers that are trying to reduce or eliminate risk, standardisation makes it difficult to precisely hedge a position.

For non-hedging investors who are entering into contracts expecting compensation for taking the opposite side of a hedge or who are taking a position based on expectations about future performance of an underlying, standardisation of the contracts is not problematic.

Distinctions between Forwards and Futures

2. Liquidity.

Forward contracts trade in the over-the-counter market and are illiquid.

Futures contracts are relatively liquid; they trade on exchanges and can be bought and sold at times other than initiation.

An investor can close out (cancel) a position using futures contracts relatively easily.

Distinctions between Forwards and Futures

3. Counterparty Risk. Counterparty risk is potentially very high in forward contracts. That is, the risk that one party may be unwilling or unable to fulfil its contractual obligations.

Futures contracts have lower counterparty risk. The presence of an exchange or a clearing house as the intermediary for all buyers and all sellers helps reduce counterparty risk.

Counterparty risk cannot be eliminated completely, however, because there is always a remote chance that the exchange fails to fulfil its own contractual obligations.

Distinctions between Forwards and Futures

4. Transaction Costs.

There can be significant costs to arrange a forward contract. Transaction costs usually are embedded in forward contracts and are not easily visible to the customer.

Futures contracts, however, are traded on exchanges through brokerage firms or brokers (agents authorised to trade directly with the exchange), and the transaction costs are visible.

So, there is more transparency in the futures markets.

Distinctions between Forwards and Futures

4. Transaction Costs (continued).

A broker typically earns the difference between the bid and ask prices as a commission to arrange the trade.

Because futures contracts are standardised, transaction costs are relatively low.

PS: bid price is the price at which a dealer is prepared to buy, and the ask (or offer) price is the price at which a dealer is prepared to sell.

Distinctions between Forwards and Futures

5. Timing of Cash Flows. Forward contracts have no cash flows except at maturity. Futures contracts are marked to market daily.

It is important to note that if forward and futures contracts with identical terms are held to maturity, the final outcome is the same.

For a forward contract, the entire effect of changing prices is taken into account at maturity, whereas for a futures contract, the effect of changing prices is taken into account on an ongoing basis.

Distinctions between Forwards and Futures

6. Settlement.

Forward contracts may settle with physical delivery or cash settlement. Futures contracts are typically settled with cash.

PS: Table 1 provides a comparison of forward and futures contracts.

Table 1: Comparison of Forward and Futures Contracts

Similarities

- Both types of contracts exist on a wide range of underlyings, including shares, bonds, agricultural products, and precious and industrial metals, among others.

Differences

- Forwards are customised contracts that trade in private over-the-counter markets, whereas futures are standardised contracts that trade on exchanges.

Table 1: Comparison of Forward and Futures Contracts

Similarities

- For both types of contracts, both the buyer and seller have obligations.

Differences

- Counterparty risk is high with forward contracts, but limited with futures contracts. Requirements imposed by exchanges, such as initial and maintenance margins and daily marking to market, reduce the counterparty risk associated with futures contracts.

Table 1: Comparison of Forward and Futures Contracts

Similarities

- Both types of contracts allow locking in a price today for a transaction that will occur in the future.

Differences

- It is easier to exit a position prior to the settlement date with a futures contract than with a forward contract.
- A position in a futures contract can be settled (closed) by taking an opposite position in the same contract.

Advantages of Futures

(a) **Transaction** costs should be **lower** than other hedging methods.

(b) Futures are **tradeable** and can be bought and sold on a secondary market so there is **pricing transparency**, unlike forward contracts where prices are set by financial institutions.

(c) The **exact date** of **receipt** or **payment** of the currency does **not have to be known**, because the futures contract does not have to be closed out until the actual cash receipt or payment is made.

Disadvantages of Futures

(a) The **contracts cannot be tailored** to the user's exact requirements.

(b) **Hedge inefficiencies** are caused by having to deal in a **whole number of contracts** and by **basis risk** (the risk that the futures contract price may move by a different amount from the price of the underlying currency or commodity).

(c) Only a **limited number of currencies** are the subject of futures contracts.
(d) Unlike options (see below), they do not allow a company to take advantage of favourable currency movements.

Main Types of Derivatives Contracts: 3. Option contracts

What if the farmer does not want to lock in the price because the farmer thinks the price of wheat is going to increase?

But the farmer does want to make sure that at least a certain amount is received for the wheat.

Similarly, the cereal producer thinks that the price of wheat is going to decrease, but wants to make sure that no more than a certain amount is paid.

Option markets may provide the solution for both parties.

Main Types of Derivatives Contracts: 3. Option contracts

Options give one party (the buyer) to the contract the right to demand an action from the other party (the seller) in the future.

In an **option contract**, the buyer of the option has the right, but not the obligation, to buy or sell the underlying.

Options are termed unilateral contracts because only one party to the contract (the seller) has a future commitment that, if broken, represents a breach of contract.

Unilateral contracts expose only the buyer to the risk that the seller will not fulfil the contractual agreement.

Main Types of Derivatives Contracts: 3. Option contracts

The buyer of the contract will exercise the right or option if conditions are favourable or if specified conditions are met.

For this reason, options are also known as contingent claims—that is, claims are dependant on future conditions.

If the buyer decides to use (exercise) the option, the seller is obligated to satisfy the option buyer's claim.

If the buyer decides not to exercise the option, it expires without any action by the seller.

Main Types of Derivatives Contracts:
3. Option contracts

Options may trade in the over-the-counter market, but they trade predominantly on exchanges.

In this course, we focus on options traded on exchanges.

Options in the over-the-counter market are similar, except that they are customisable.

Main Types of Derivatives Contracts:
3. Option contracts

An option contract specifies the underlying, the size, the price to trade the underlying in the future (called the **exercise price** or **strike price**), and the expiration date.

Options contracts typically expire in March, June, September, or December, but options are also available for other months.

Main Types of Derivatives Contracts: 3. Option contracts

A buyer chooses whether to exercise an option based on the underlying's price compared with the exercise price.

A buyer will exercise the option only when doing so is advantageous compared with trading in the market, which puts the seller at a disadvantage.

Because of the unilateral future obligation (only the seller has an obligation), options have positive value for the buyer at the inception of the contract. The option buyer pays this value, or **option premium**, to the option seller at the time of the initial contract.

Main Types of Derivatives Contracts:
3. Option contracts

The premium paid by the option buyer compensates the option seller for the risk taken; the option seller is the only party with a future obligation.

The maximum benefit to the option seller is the premium.

The option seller hopes the option will not be exercised.

3. Option contracts: Call Options and Put Options

There are two basic types of options: options to buy the underlying, known as call options, and options to sell the underlying, known as put options.

An investor who buys a **call option** has the right (but not the obligation) to buy or call the underlying from the option seller at the exercise price until the option expires.

An investor who buys a **put option** has the right (but not the obligation) to sell or put the underlying to the option seller at the exercise price until expiration.

3. Option contracts: Call Options and Put Options

The cereal producer may buy a call option to secure the right, but not the obligation, to buy wheat at the exercise price.

The farmer may buy a put option to secure the right, but not the obligation, to sell wheat at the exercise price.

Note that the cereal producer and farmer enter into totally different option contracts to manage their risks.

An example describing how a call option works in practice is presented in the next slide

3. Option contracts: Illustration of a Call Options

Consider a call option in which the underlying is 1,000 shares of hypothetical Company A trading on the Nairobi Securities Exchange (NSE).

The call option's exercise price is Kshs.6.00 per share, which means that the call option buyer can buy 1,000 shares of Company A at Kshs 6.00 per share until expiration, regardless of Company A's share price in the market.

Note that the buyer will exercise this option only if Company A's price on the NSE is more than Kshs 6.00 per share.

3. Option contracts: Illustration of a Call Options

If Company A's share price at expiration is Kshs.7.00 per share, the buyer exercises the option, pays Kshs.6,000, and receives 1,000 shares of Company A.

The call option buyer can then sell those shares in the market for a profit of Kshs.1,000 (ignoring transaction costs, such as the premium paid for the call option and trading costs).

The seller of the call option is obligated to sell the shares at Kshs.6.00 per share to the call option buyer, even though the market price is Kshs.7.00 per share, incurring a loss of Kshs.1,000 (ignoring the premium received for the call option).

3. Option contracts: Illustration of Call Options

If Company A's share price is less than Kshs.6.00 per share, the call option buyer has no incentive to exercise the option; it would not make sense to voluntarily pay more than the market price.

In this case, the buyer will let the option expire.

Because an option buyer is not forced to exercise an option, an option's value cannot be negative.

3. Option contracts: Illustration of Call Options

The example illustrates that, ignoring the premium paid, an option buyer's payoff is never negative.

Option buyers pay premiums to option sellers to compensate option sellers for their risk.

But if an option seller underestimates the risk associated with the option, the premiums paid may be far less than the losses they incur on exercise.

3. Option contracts: Call Options and Put Options

Call options protect the buyer by establishing a maximum price the option buyer will have to pay to buy the underlying; the maximum price is the exercise price.

- A call option is said to be "in the money" if the market price is greater than the exercise price. In this case, the option would be exercised.
- A call option is "out of the money" if the market price is less than the exercise price. In this case, the option would not be exercised.
- A call option is "at the money" if the market price and exercise price are the same. In this case, the option may be exercised.

3. Option contracts: Call Options and Put Options

Put options protect the buyer by establishing a minimum price the option buyer will receive when selling the underlying; the minimum price is the exercise price.

- A put option is said to be "in the money" if the market price is less than the exercise price. In this case, the option would be exercised.
- A put option is "out of the money" if the market price is greater than the exercise price. In this case, the option would not be exercised.

3. Option contracts: Call Options and Put Options

- A put option is "at the money" if the market price and exercise price are the same. In this case, the option may be exercised.

An option's in- or out-of-the-money designation, also known as "moneyness", reflects whether it would be profitable for the buyer to exercise the option at the current time.

3. Option contracts: Factors that Affect Option Premiums

Option premiums are expected to compensate option sellers for their risk.

The option premium represents the maximum profit that the option seller can make.

If an option seller underestimates the risk associated with the option, the premiums may be far less than the losses incurred if the option is exercised.

3. Option contracts: Factors that Affect Option Premiums

The lower the exercise price for a call option relative to the current spot price, the higher the premium because the likelihood that it will be exercised is greater.

The higher the exercise price for a put option relative to the current spot price, the higher the premium because the likelihood that it will be exercised is greater.

3. Option contracts: Factors that Affect Option Premiums

The longer the time to expiration of an option, the higher the option premium because the likelihood is greater that the underlying will change in favour of the option buyer and that it will be exercised.

Similarly, the greater the volatility of the underlying, the higher the option premium because the likelihood is greater that the underlying will change in favour of the option buyer and that it will be exercised.

3. Option contracts: Factors that Affect Option Premiums

In summary, an option's premium depends on the current spot price of the underlying, exercise price, time to expiration, and volatility of the underlying.

Table 2 shows the effects on an option's premium for a call option and a put option of an increase in each factor.

Table 2: Effects on Premiums for a Call Option and a Put Option of an Increase in a Factor

Factor Increasing	Call Option Premium	Put Option Premium
Underlying's price	Increases	Decreases
Exercise price	Decreases	Increases
Time to expiration	Increases	Decreases
Underlying's volatility	Increases	Increases

3. Option contracts: Currency options

Currency options protect against **adverse exchange rate movements** while allowing the investor to take advantage of favourable exchange rate movements.

They are particularly useful in situations where the cash flow is not certain to occur (eg when tendering for overseas contracts).

3. Option contracts: Currency options

A currency **option** is a right of an option holder to buy (call) or sell (put) a quantity of one currency in exchange for another, at a specific exchange rate (the exercise rate, exercise price or strike price) on or before a future expiry date.

If a buyer exercises the option, the option seller must sell or buy at this rate.

If an option is not exercised, it lapses at the expiry date.

3. Option contracts: Currency options

The exercise price for the option may be the same as the current spot rate, or it may be more favourable or less favourable to the option holder than the current spot rate.

Companies can choose whether to buy:

(a) A tailor-made currency option from a bank, suited to the company's specific needs. These are **over the counter** (OTC) or **negotiated** options; or

(b) A standard option, in certain currencies only, from an options exchange. Such options are **traded** or **exchange-traded** options.

3. Option contracts: Currency options

Because of the flexibility offered by currency options – the holder can exercise the option at any point, or choose to sell the option – it allows the holder to enjoy the upside without a risk of suffering the downside.

However, buying a currency option involves **paying a premium to the option seller**. The option premium is a **cost** of using an option.

It is the most the buyer of the option can lose by hedging an exposure to currency risk with an option: this maximum loss occurs if the option is not exercised, but is allowed to lapse.

Example: Currency options

Currency options will be exercised by the option holder only if the exercise rate in the option is more favourable than the spot rate at the exercise date for the option.

For example, a company may buy a currency call option, giving it the right to buy US$6,000,000 in 2 months' time in exchange for sterling at an exercise rate of $1.5000.

Buying the dollars at this rate would cost £4,000,000.

Example: Currency options

(a) If the spot exchange rate at the exercise date is $1.60, the option holder will let the option lapse and will buy the dollars at the spot rate for £3,750,000.

(b) If the spot exchange rate at the exercise date is $1.40, the option holder will exercise the option and will buy the dollars at the exercise rate of $1.50. (Buying at the spot rate would cost £4,285,714.)

Example: Currency options

Similarly, a company may buy a currency put option, giving it the right to sell US$2,800,000 in 2 months' time in exchange for sterling at an exercise rate of $1.4000. The dollars could be sold at this rate for £2,000,000.

(a) If the spot exchange rate at the exercise date is $1.35, the option holder will let the option lapse and will sell the dollars at the spot rate for £2,074,074.

(b) If the spot exchange rate at the exercise date is $1.45, the option holder will exercise the option and will sell the dollars at the exercise rate of $1.40. (Selling at the spot rate would earn £1,931,034.)

Purpose of Currency options

The purpose of currency options is to reduce or eliminate exposure to currency risks, and they are particularly useful for companies in the following situations.

(a) Where there is **uncertainty** about **foreign currency receipts or payments**, either in timing or amount. Should the foreign exchange transaction not materialise, the option can be sold on the market (if it has any value) or exercised if this would make a profit.

Purpose of Currency options

(b) To **support the tender** for an **overseas contract** by a company, priced in a foreign currency. The option would be to sell the currency earned from the contract. If the company does not win the contract, it can let the option lapse (or make a profit on a favourable movement in the spot rate). In this situation, an option would be preferable to a binding forward contract, because it does not know whether or not it will need to sell any currency.

Purpose of Currency options

(c) To allow **the publication of price lists** for its goods **in a foreign currency**. A company can arrange a number of currency options to sell a quantity of the foreign currency in exchange for its domestic currency, covering the time period for which the price list remains valid.

In both situations (b) and (c), the company would not know whether it had won any export sales or would have any foreign currency income at the time that it announces its selling prices. It cannot make a forward exchange contract to sell foreign currency without becoming exposed in the currency.

Drawbacks of Currency options

a) They have a cost (the 'option premium'). The **cost** depends on the **expected volatility** of the **exchange rate**, the choice of **exercise rate** and **the length of time to the expiry date for the option**.

b) Options must be paid for **as soon** as they are **bought**.

c) Tailor-made options (arranged over the counter with a bank) **lack negotiability**.

d) Traded options are **not available** in **every currency**.

Main Types of Derivatives Contracts: 4. Swap Contracts

Swaps are typically derivatives in which two parties exchange (swap) cash flows or other financial instruments over multiple periods (months or years) for mutual benefit, usually to manage risk.

Main Types of Derivatives Contracts: 4. Swap Contracts

Swaps of this type involve obligations in the future on the part of both parties to the contract.

These swaps, like forwards and futures, are forward commitments or bilateral contracts because both parties have a commitment in the future.

Similar to forwards and futures, a contract's net initial value to each party should be zero and as one side of the swap contract gains the other side loses by the same amount.

Main Types of Derivatives Contracts: 4. Swap Contracts

Swaps in which two parties exchange cash flows include interest rate and currency swaps.

An **interest rate swap**, the most common type, allows companies to swap their interest rate obligations (usually a fixed rate for a floating rate) to manage interest rate risk, to better match their streams of cash inflows and outflows, or to lower their borrowing costs.

Main Types of Derivatives Contracts: 4. Swap Contracts

A **currency swap** enables borrowers to exchange debt service obligations denominated in one currency for equivalent debt service obligations denominated in another currency.

Currency swaps effectively involve the exchange of debt from one currency to another. Currency swaps can provide a **hedge** against exchange rate movements for longer periods than the forward market, and can be a means of obtaining finance from new countries.

By swapping future cash flow obligations, the two parties can manage currency risk.

Example: Currency Swap

Company C, a US firm, wants to do business in Europe. At the same time, Company D, a European firm, wants to do business in the United States. The US firm needs euros and the European firm needs dollars, so the companies enter into a five-year currency swap for $50 million. Assume that the exchange rate is $1.25 per euro. On this basis, Company C pays Company D $50 million, and Company D pays €40 million to Company C. Now each company has funds denominated in the other currency (which is the reason for the swap). The two companies then exchange monthly, quarterly, or annual interest payments. Finally, at the end of the five-year swap, the parties re-exchange the original principal amounts and the contract ends.

Benefits of a Currency Swap

(a) Swaps are **easy to arrange** and are **flexible** since they can be arranged in any size.

(b) **Transaction costs are low**, only amounting to legal fees, since there is no commission or premium to be paid.

(c) The parties can **obtain the currency they require** without subjecting themselves to the **uncertainties** of the spot foreign exchange markets.

Benefits of a Currency Swap

(d) The company can gain **access to debt finance in another country** and currency where it is little known, and consequently has a poorer credit rating, than in its home country. It can therefore take advantage of lower interest rates than it could obtain if it arranged the currency loan itself.

(e) Currency swaps may be used to **restructure the currency base** of the company's liabilities. This may be important where the company is trading overseas and receiving revenues in foreign currencies, but its borrowings are denominated in the currency of its home country.

Currency swaps therefore provide a means of reducing exchange rate exposure.

Benefits of a Currency Swap

(f) A currency swap could be used to **absorb excess liquidity** in one currency which is not needed immediately in order to create funds in another where there is a need.

In practice, most currency swaps are conducted between banks and their customers. An agreement should only be necessary if the swap were for longer than, say, one year.

For shorter periods, a forward exchange contract should be arranged if a currency hedge is required.

End of Chapter Questions - MCQs

1 The value of a derivatives contract is *most likely* to be directly affected by the:

A price of the underlying. **B** supply of the underlying. **C** demand for the underlying.

2 Counterparty risk is *most likely* lowest for: **A** swap contracts. **B** futures contracts.

C forward contracts.

3 A farmer will harvest his corn crop in six months but wants to lock in a price today. The farmer will *most likely*: **A** buy a corn futures contract. **B** sell a corn futures contract. **C** buy a corn forward contract.

4 Forward contracts and futures contracts, with otherwise identical terms, are similar with respect to:

A counterparty risk. **B** payoffs at maturity. **C** customisation of contracts.

End of Chapter Questions - MCQs

5 Relative to a futures contract, an advantage of a forward contract is:

A greater liquidity. **B** lower counterparty risk. **C** the ability to customise the contract.

6 Which of the following parties to an option contract on a company's shares has the right to buy shares at the exercise price?

A Put seller **B** Call seller **C** Call buyer

7 Which of the following parties to an option contract on a company's shares is obligated to buy shares at the option strike price if the option is exercised?

A Put seller **B** Put buyer **C** Call seller

End of Chapter Questions - MCQs

8 Which of the following options would be described as being in the money?

A A put option in which the underlying's price is lower than the exercise price.

B A call option in which the underlying's price is lower than the exercise price.

C A put option in which the underlying's price is higher than the exercise price.

End of Chapter Questions - MCQs

9 A call option contract on shares of Company A has an exercise price of €50. The option is in the money when the share price of Company A is:

A €45. **B** €50. **C** €55.

10 A put option on shares of Company B has an exercise price of £40. The option is out of the money when the share price of Company B is:

A £35. **B** £40. **C** £45.

11 Swap contracts:

A are mostly traded on exchanges. **B** have an initial net value of zero. **C** are not susceptible to counterparty risk.

Next Class

3) Role, structure and regulation of global derivatives markets;
4) Derivatives market terminology;
5) Key market participants and roles;
6) The purposes of derivative markets; and
7) Criticisms of derivative markets