

# LECTURE 1

## (Chapter 1 & 2 Introduction and Structure of Derivative Markets)

### The “Greeks” in Investment & Option Analysis

A romantic poem written by Professor Droussiotis

*A positive ALPHA is all you need*

*A measurable SIGMA is all you seek*

*Know your BETA, DELTA & GAMMA*

*And you won't have any problems capturing LAMBDA*

*Too much THETA will drill you*

*But a little EPSILON, IOTA and ETA could kill you*

*Since your investors depend on you*

*Hope to bring them zero RHO and infinite MU*

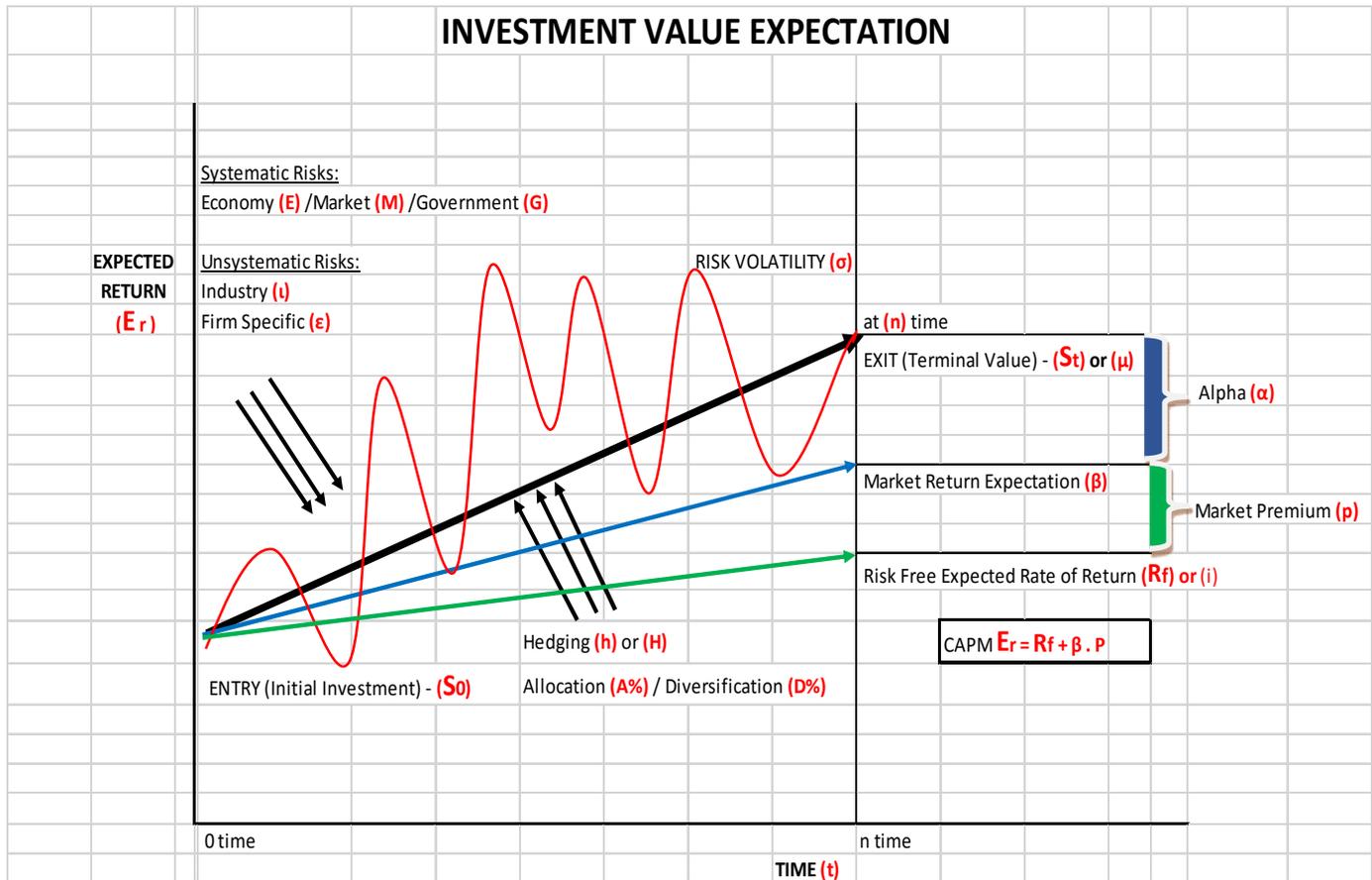
Let,

- *Alpha* ( $\alpha$ ) is the rate of return beyond the value of the market's average return.
  - *Beta* ( $\beta$ ) is the volatility of the rate of return versus the market's average return.
  - *Sigma* ( $\sigma$ ) is the standard deviation from the average rate of returns over a specific period of time.
  - *Mu* ( $\mu$ ) is the expected return
- } Underlying Asset
- *Delta* ( $\Delta$ ) is the change in the price of the underlying asset to the corresponding change in the price of a derivative - sometimes referred to as the "hedge ratio".
  - *Lambda* ( $\lambda$ ) is ratio that measures option volatility.
  - *Gamma* ( $\gamma$ ) is the change of the derivative value of the investment as compared to the change of the underlying investment value over time -second derivative to Delta.
  - *Rho* ( $\rho$ ) is the rate at which the price of a derivative changes relative to a change in the risk-free rate of interest. Rho measures the sensitivity of an option or options portfolio to a change in interest rate.
  - *Theta* ( $\theta$ ) is a measure of the rate of time premium decay.
- } Option
- *Epsilon* ( $\epsilon$ ) is the unsystematic risk – company specific.
  - *Iota* ( $\iota$ ) is the unsystematic risk – industry specific.
- Eta* ( $\eta$ ) is the unsystematic risk – type of investment interest (liquidity premium)
- } Unsystematic Risk

# INTRODUCTION TO DERIVATIVES

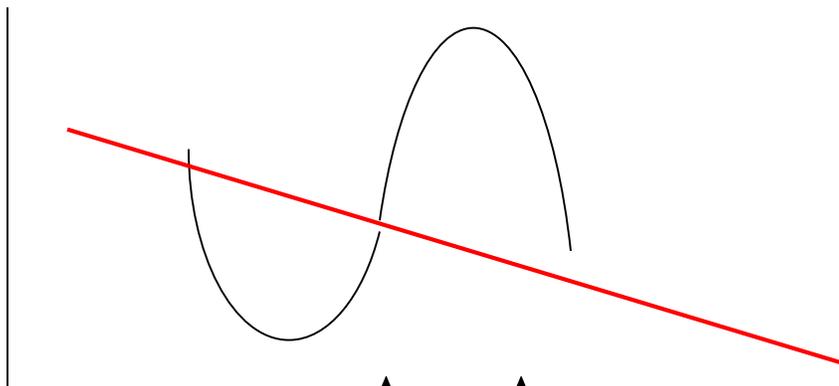
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## Return, Risk Volatility, Time



## Derivatives in Math (Calculus)

- A derivative is a measure of how a function changes as its input changes.
- 



$$\Delta y = m \cdot \Delta x$$

i(y being the independent variable, x the independent variable and m the rate of change or the slope)

### Derivatives in Finance – Few General Concepts

Locking the price today to mitigate any changes of that price in the future and pay for that option today or honor the obligation in the future.

#### Few headlines:

**AIG Loses** - \$100 Billion - Massive Government Bailout (Sep 08)

**Goldman Sachs / Paulson & Co Hedge Fund**

#### USE DERIVATIVES FOR INSURANCE / PROTECTING / HEDGING – RESPONSIBLE RISK MANAGER

- A **derivative** is an agreement between two people or two parties - that has a value determined by the price of something else (**called the underlying asset (financial or real asset)**).
- It is a financial contract with a value linked to the expected future price movements of the asset it is linked to - such as a share or a currency.
- Relationship between the underlying and the derivative (e.g., forward, option, swap)
- Type of underlying (e.g., equity derivatives, foreign exchange derivatives, interest rate derivatives, commodity derivatives or credit derivatives)
- Market in which they trade (e.g., exchange-traded or over-the-counter)
- Notional Amount - the size of the derivative contract
- Derivatives as a Financial “Bet” – Pricing the “Bet” – i.e. toss of a coin
- Transfer of risk concept – One winner=one loser – no additional technical risk

Why use/invest in Derivatives:

- **Speculate** and to make a profit if the value of the underlying asset moves the way they expect (e.g., moves in a given direction, stays in or out of a specified range, reaches a certain level)
- **Hedge or mitigate risk** in the underlying, by entering into a derivative contract whose value moves in the opposite direction to their underlying position and cancels part or all of it out
- **Obtain exposure** to underlying where it is not possible to trade in the underlying (e.g., weather derivatives)
- **Create optionability** where the value of the derivative is linked to a specific condition or event (e.g., the underlying reaching a specific price level)

### Broad Types – Derivative Markets & Instruments – Chapter 2

- Options
- Forward Contracts
- Futures Contracts
- Swaps and Other Derivatives

#### Options:

#### Definition and Highlights:

- **Option** is a derivative financial instrument that establishes a contract between two parties concerning the buying or selling of an asset at a reference price in the future during a specified time frame.
- During this time frame, the buyer of the option gains **the right, but not the obligation**, to engage in some specific transaction on the asset, while the seller incurs the obligation to fulfill the transaction if so requested by the buyer.
- The price of an option derives from the value of an underlying asset (commonly a stock, a bond, a currency or a futures contract) plus a premium based on the time remaining until the expiration of the option.
- Other types of options exist, and options can in principle be created for any type of valuable asset.
- An option which conveys the right to buy something is called a call
- An option which conveys the right to sell is called a put.
- The price specified at which the underlying may be traded is called the strike price or exercise price.
- The process of activating an option and the rebuy trading the underlying at the agreed-upon price is referred to as exercising it. Most options have an expiration date. If the option is not exercised by the expiration date, it becomes void and worthless.
- In return for granting the option, called writing the option, the originator of the option collects a payment, the premium, from the buyer.
- The writer of an option must make good on delivering (or receiving) the underlying asset or its cash equivalent, if the option is exercised.
- Payoff and profit Concepts (Out of the money, at the money, in the money concepts)
- European vs American Option
- Last trading day & Expiration Day (Last trading day is the 3<sup>rd</sup> Friday of expiration month)

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- Expiration Cycles: Jan, Apr, Jul, Oct or Feb, May, Aug, Nov or Mar, Jun, Sep, Dec
- Long Term Equity Anticipation Securities (LEAPS) – long term options
- Exchange & Exchange Trading (CBOE)
- Option Clearing Corporation & Clearing Firms (Option Buyer – settles the day after exercise, Option seller has margin account with broker)

### Call Option (the right to buy) – example:

Microsoft is currently selling (April 29, 2014 at \$40.72, to lock in the right to buy at \$43 from not until June 21 you pay \$0.33 premium):

$$S_0 = \$40.72$$

$$S_t = \$43.00$$

$$P = \$0.33 \text{ (Pricing the bet)}$$

If S ends up at \$43.10 would you exercise? What is the Payoff, What is the profit?

### Put Option (the right to Sell) – example:

Microsoft is currently selling (April 29, 2014 at \$40.72, to lock in the right to sell at \$43 from not until June 21 you pay \$2.91 premium):

$$S_0 = \$40.72$$

$$S_t = \$43.00$$

$$P = \$2.91 \text{ (pricing the bet)}$$

Is the Put Option in the market on day one? What is the BE?

## Forward Contract:

### Definition and Highlights:

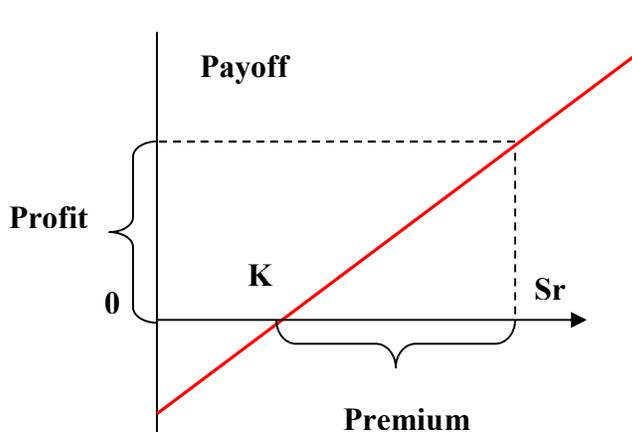
- **Forward contract** or simply a **forward** is a contract between two parties to buy or sell an asset at a specified future time at a price agreed today.
- This is in contrast to a spot contract, which is an agreement to buy or sell an asset today.
- It costs nothing to enter a forward contract (**Zero value to both sites**).
- The party agreeing to buy the underlying asset in the future assumes a **long position**, and the party agreeing to sell the asset in the future assumes a **short position**.
- The price agreed upon is called the **delivery price**, which is equal to the forward price at the time the contract is entered into.

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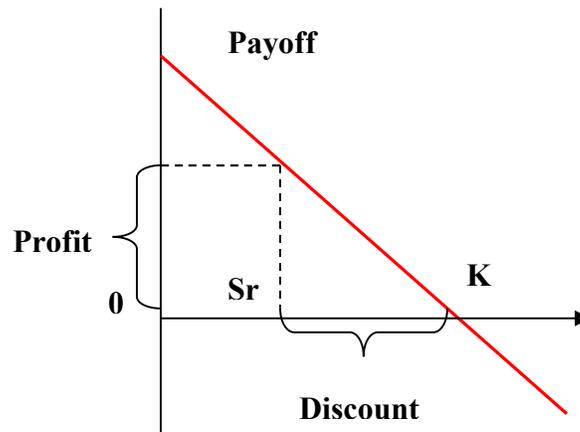
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- The forward price of such a contract is commonly contrasted with the spot price, which is the price at which the asset changes hands on the spot date. The difference between the spot and the forward price is the **forward premium or forward discount**, generally considered in the form of a profit, or loss, by the purchasing party.
- Forwards, like other derivative securities, can be used to **hedge risk** (typically currency or exchange rate risk), as a means of speculation, or to allow a party to take advantage of a quality of the underlying instrument which is time-sensitive.

### LONG POSITION



### SHORT POSITION



### Example of Forwards

- A trader enters into long forward contract on January 20, 2010, to buy £1 million in 3 months at an exchange rate 1.6196 (**K**= delivery price).
- The contract will obligate the trader to buy £1 million for \$1,619,600.
- If the **spot exchange rate** (**Sr**) rose to to 1.6500, at the end of the three months, the trader would gain \$30,400 (\$1,650,000– \$1,619,600) because the pounds, as soon as they have been purchased, can be sold for \$1,650,000.
- If the spot exchange rate fell to 1.550 at the end of the 90 days, the trader would lose \$69,600 because the forward contract would lead to the trader paying \$69,600 more than the market price for sterling.

$$\mathbf{Sr - K} \text{ (long position) or } \mathbf{K - Sr} \text{ (short position)}$$

### Example:

Microsoft is currently selling (April 29, 2014 at \$40.72, One party agrees to buy at \$43 on June 21 and the party has the obligation to sell it at \$43 on June 21 – No premium since there is no option

$$S_0 = \$40.72$$

$$K_t = \$43.00$$

$$P = \$0$$

### Futures Contract:

#### Definition and Highlights:

- A closely related contract is a futures contract; they differ in certain respects. Forward contracts are very similar to futures contracts, except they are not exchange traded, or defined on standardized assets.
- **Futures contract** is a standardized contract between two parties to buy or sell a specified asset of standardized quantity and quality at a specified future date at a price agreed today (*the futures price*).
- The contracts are traded on a futures exchange (CBOT – Chicago Board of Trade or CME – Chicago Merchandile Exchange).
- Futures contracts are not "direct" securities like stocks, bonds, rights or warrants. They are still securities, however, though they are a type of derivative contract.
- The party agreeing to buy the underlying asset in the future assumes a *long position*, and the party agreeing to sell the asset in the future assumes a *short position*.
- The **price** is determined by the instantaneous equilibrium between the forces of supply and demand among competing buy and sell orders on the exchange at the time of the purchase or sale of the contract.
- The underlying asset to a futures contract – the most common are commodities. They could also be financial futures, such as currencies, securities or financial instruments and intangible assets or referenced items such as stock indexes and interest rates.
- The future date is called the *delivery date or final settlement date*.
- Not an exact date (delivery month – entire month) – different than the Forwards.

## INTRODUCTION TO DERIVATIVES

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- The official price of the futures contract at the end of a day's trading session on the exchange is called the settlement price for that day of business on the exchange.

### Swaps:

#### **Definition and Highlights:**

- **Swap** is a derivative in which counterparties exchange certain benefits of one party's financial instrument for those of the other party's financial instrument.
- The benefits in question depend on the type of financial instruments involved.
- For example, in the case of a swap involving two bonds, the benefits in question can be the periodic interest (or coupon) payments associated with the bonds.
- Specifically, the two counterparties agree to exchange one stream of cash flows against another stream. These streams are called the legs of the swap.
- The swap agreement defines the dates when the cash flows are to be paid and the way they are calculated.
- Usually at the time when the contract is initiated at least one of these series of cash flows is determined by a random or uncertain variable such as an interest rate, foreign exchange rate, equity price or commodity price.
- The cash flows are calculated over a notional principal amount, which is usually not exchanged between counterparties. Consequently, swaps can be in cash or collateral.
- Swaps can be used to hedge certain risks such as interest rate risk, or to speculate on changes in the expected direction of underlying prices.

### Other Derivatives:

- **Credit Default Swaps (CDS) – Event driven derivatives**
- **Callable Bonds/Puttable bonds/Convertible Bonds (“embedded derivative – part of the asset class)**