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# Presentation Outline

- Greeks Overview
- Delta
  - Definition
  - Characteristics
- Gamma
- Vega
  - HV vs IV
  - Example
- Theta
  - Rate of Decay
  - Near term vs Long term



# Greeks Overview



# The Five Greeks

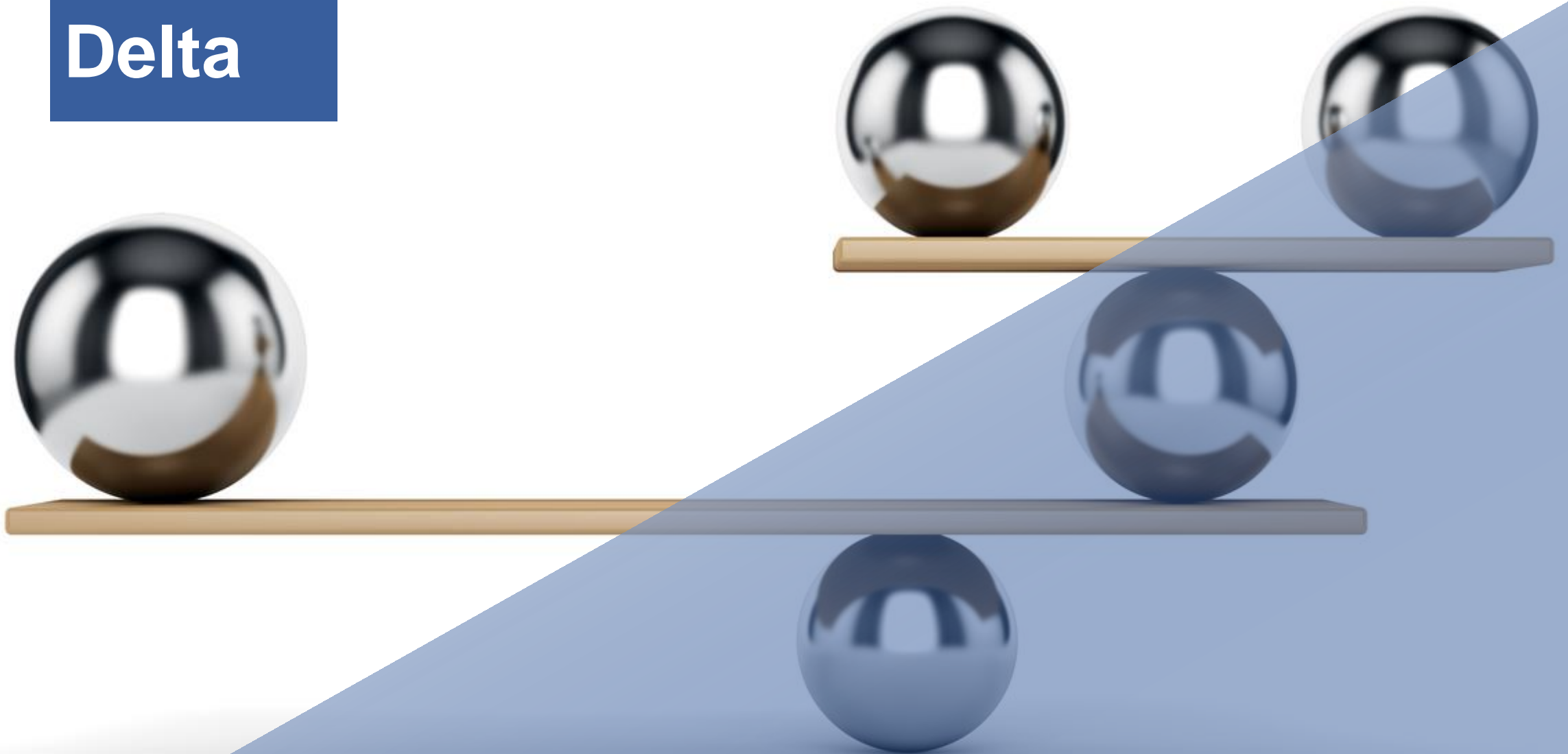
- Δ Delta** Expected change in option value with changing underlying stock price
- Γ Gamma** Expected change in option delta with changing underlying stock price
- Θ Theta** Expected change in option value with passage of time (time decay)
- K Vega** Expected change in option value with changing implied volatility
- ρ Rho** Expected change in option value with changing risk free interest rate

# Nature of the Greeks

- Greeks are theoretical measurements
  - Like theoretical values, Greeks don't guarantee
  - Market prices may or may not perform as indicated
- Each Greek isolates risk from a single pricing factor
  - Assumes other factors are unchanged
- Conditions change in a dynamic marketplace
  - Stock prices, volatility, time
  - Option prices are sensitive to these changes



Delta





# Option Delta – A definition



**Delta: Value's sensitivity to stock price**

The **expected** change in an option's price (up or down) for each 1-point move in underlying stock price

## **Deep in-the-money options**

- High deltas approaching 100% (or 1)

## **At-the-money options**

- Deltas around 50% (or .50)





## **Far out-of-the-money options**

- Low deltas approaching 0% (or 0)







# Delta Characteristics

## Calls have positive (long) deltas

- Positive correlation to underlying stock price change
- Stock price  → call price 
- Stock price  → call price 
- Call deltas range from 0 to +1.00

## Puts have negative (short) deltas

- Negative correlation to underlying stock price change
- Stock price  → put price 
- Stock price  → put price 
- Put deltas range from 0 to -1.00

# Delta as ITM Probability

Another way investors might use delta is to determine **probability of option finishing ITM**

- Buying a 70 delta call could indicate a 70% chance of the option finishing **ITM**, and
- Selling a 30 delta call could indicate a 70% chance of the option finishing **OTM**

ITM/OTM does not equal **PROFITABILITY!**

# Gamma



# Gamma

**Γ** Gamma: Delta's sensitivity to stock price

The anticipated change in the delta value for a \$1.00 move in the underlying stock

- All other pricing factors constant
- In decimal form (e.g., .002)
- **Adjustment to Delta**

Only options have gamma

**Γ**  
Gamma

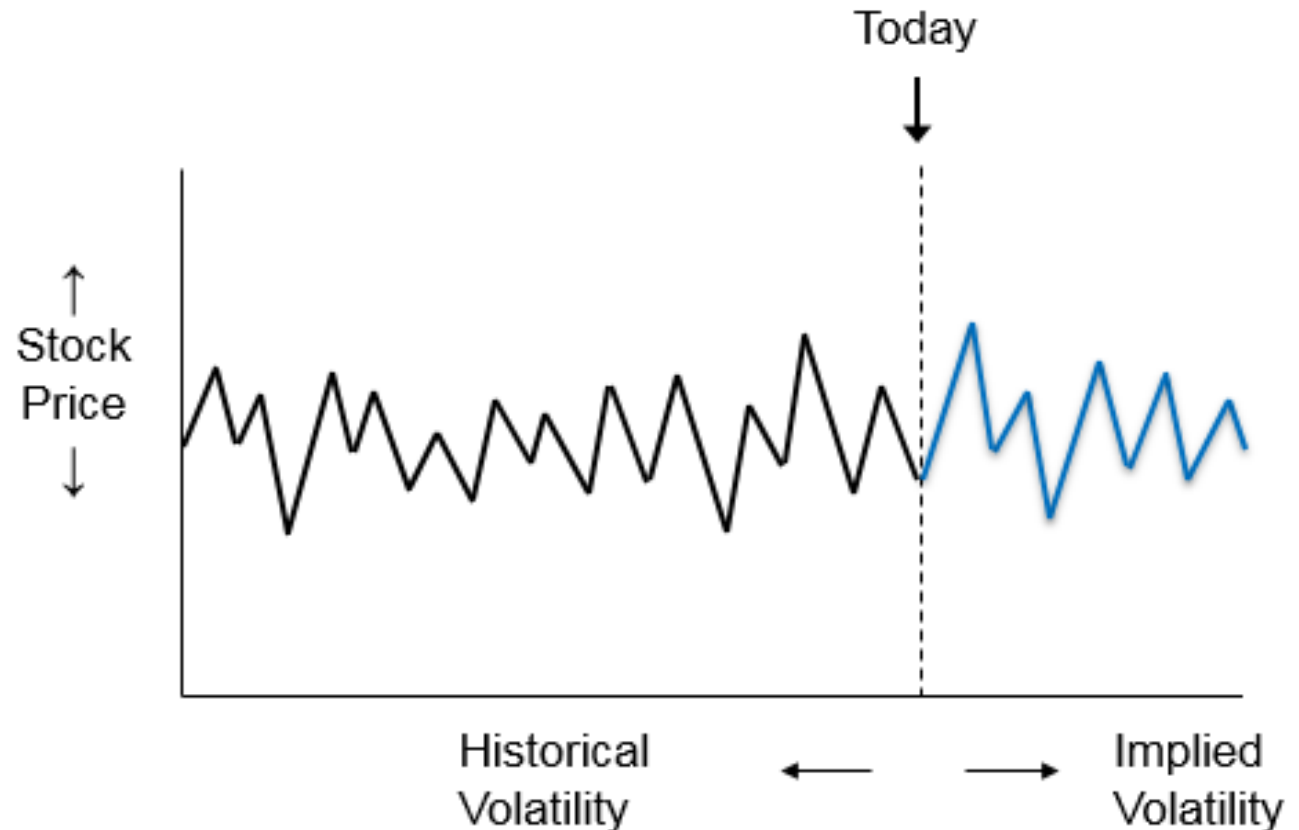
**Vega**



# Historical Volatility (HV)

A stock's volatility in the past

- Can be observed and quantified
- This is “historical” volatility
- A statistic, or a fact-- not a prediction





# Implied Volatility (IV): Definition

- Option implied volatility:
  - Volatility level that justifies an options price
  - Can be determined via option pricing model (calculator)
- Reflects underlying stock volatility expected by marketplace:
  - Consensus of all market participants
- Who ultimately determines option market prices?
  - Everybody who makes a bid/ask price and trades an option
  - Professionals and individual investors alike

# Implied Volatility: Effect on Option Prices

- A change in underlying stock historical volatility may or may not affect an option's market price. However...
- **Other pricing factors remaining constant, a change in implied volatility will affect option prices:**
- As implied volatility increases ↑
  - both call and put prices will increase ↑
- As implied volatility decreases ↓
  - both call and put prices will decrease ↓

# Vega: The Volatility Greek

**K** Vega: Option value's sensitivity to volatility

- Expected change in option value
  - With a 1%-point change in implied volatility (IV)
  - Expressed in decimal form (.080)
  - Represents cash amount per option
  - All other pricing factors constant
- Calls and puts both have positive Vega amounts
  - IV **↑** option value **↑** by Vega amount
  - IV **↓** option value **↓** by Vega amount

**K**  
Vega

# Theta (Time Decay)



# Theta (Time Decay)



**Theta: Option value's sensitivity to time**

## **Expected time decay in option value**

- With the passage of 1 day
- Expressed in decimal form (-.080)
- Decay is per calendar day, not per trading day
- Represents cash amount per option
- All other pricing factors constant

**Calls and puts both have negative theta amounts**



Theta





Greeks are mathematical calculations used to determine the effect of various factors on options.

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