Hedging & Delta Hedging – Notes

1. Fun Example: Hedging in Everyday Life

Imagine you're planning a picnic, but the weather forecast says it might rain. You decide to bring an umbrella. If it rains, you stay dry; if it doesn't, you just carry the umbrella. Bringing the umbrella is a hedge against the risk of rain.

In finance, hedging works the same way: you take steps to protect yourself from possible losses, even if it costs a little extra.

2. What is Hedging?

- Hedging means reducing or removing risks that could hurt your investments.
- It's like buying insurance for your portfolio: you pay a small cost now to avoid a big loss later.
- You can hedge against many risks: stock market crashes, currency changes, interest rate moves, commodity price swings, and inflation.

How Hedging Works

- You add investments that move in the opposite direction of your main holdings.
- If your main investment loses value, your hedge gains value, balancing things out.
- Example: If you own a stock, you might buy a put option (the right to sell at a set price) to protect against a drop in the stock's price.

3. Types of Risks & How to Hedge Them

Risk Type	**What It Means**	**Common Hedge**
Stock Market Risk	Stocks fall in value	Put options, short selling
Currency Risk	Exchange rates move against you	Currency swaps, futures
Interest Rate Risk	Rates rise/fall, affecting bond prices	Interest rate swaps

Commodity Risk	Commodity prices change	Futures, options
Inflation Risk	Money loses value over time	Gold, inflation-linked bonds

4. What Are Option Greeks? Why Are They Important for Hedging?

Option Greeks are numbers that show how sensitive an option's price is to different factors. They help you understand and manage risk.

- Delta: Shows how much the option price changes if the stock price changes. Used for delta hedging.
- Gamma: Shows how much Delta changes if the stock price changes. Important for adjusting hedges.
- Vega: Shows how much the option price changes if volatility changes. Used to hedge against volatility risk.
- Theta: Shows how much the option price changes as time passes. Used to manage time decay risk.
- Rho: Shows how much the option price changes if interest rates change. Used to hedge interest rate risk.

Why Greeks Matter:

- They help you build hedges that protect against specific risks.
- For example, Delta helps you hedge against price moves, Vega against volatility, etc.

5. Delta Hedging Explained (Video 2 Example)

What is Delta?

- Delta measures how much an option's price changes for a $1 change in the stock price.
- Example: If a call option has a Delta of 0.5, and the stock goes up $1, the option price goes up $0.50.

Delta Hedging Basics

- If you have an option position, you can offset its risk by taking an opposite position in the stock.
- The goal: make your portfolio "delta neutral" (total Delta = 0), so small stock price changes don't affect your portfolio's value.

Detailed Example from Video 2

Let's say you are short 100,000 call options (you sold them). Each call has a Delta of 0.522.

- Total Position Delta: 0.522 × 100,000 = 52,200
- To hedge, you buy 52,200 shares of the underlying stock (each share has Delta = 1).
- Now, your portfolio's total Delta is zero: the risk from the options is offset by the shares.

Dynamic Delta Hedging

- Delta changes as stock price and time change.
- Each week, you recalculate Delta and adjust your stock holdings to keep the portfolio delta neutral.
- Example from the video:
    - Week 0: Delta = 0.522 → Buy 52,200 shares
    - Week 1: Stock price falls, Delta drops to 0.458 → Sell 6,400 shares (now hold 45,800)
    - Week 2: Delta drops to 0.4 → Sell more shares
    - As expiration nears and the call options become more "in the money," Delta approaches 1. You end up needing to buy almost 100,000 shares to stay hedged.

Key Point:

- Delta hedging is not "set and forget." You must keep adjusting your hedge as market conditions change.

6. Static vs Dynamic Hedging

- Static Hedging: Set up your hedge once and leave it. Risk: Delta will drift away from zero as time and prices change.
- Dynamic Hedging: Continuously adjust your hedge to keep Delta close to zero. Safer, but requires more work and trading.

7. Summary: Why Hedge? What to Watch Out For?

- Hedging helps protect against losses, but it costs money (like insurance premiums).
- Not all risks can be perfectly hedged, and hedges need to be managed and adjusted.
- Option Greeks are essential tools for building and maintaining effective hedges.

Long & Short Trading :

1. What is Long Trading?

- Long trading means buying a stock (or asset) because you believe its price will go up.
- You buy now, hold, and hope to sell later at a higher price.
- Profit: If the price rises, you sell for more than you paid.

- Loss: If the price falls, you sell for less than you paid.

Example:

- You buy 10 shares of Company X at $10 each ($100 total).
- If the price rises to $15, you sell for $150 and make a $50 profit.
- If the price falls to $7, you sell for $70 and lose $30.

2. What is Short Trading (Short Selling)?

- Short selling means betting that a stock's price will go down.
- You borrow shares from a broker, sell them now, and hope to buy them back later at a lower price.
- Profit: If the price drops, you buy back for less and keep the difference.
- Loss: If the price rises, you have to buy back for more, losing money.

Step-by-Step Example:

- You borrow 1,000 shares of Company Y at $10 each and sell them for $10,000.
- If the price drops to $5, you buy back for $5,000, return the shares, and keep $5,000 profit.
- If the price rises to $15, you buy back for $15,000, return the shares, and lose $5,000.

3. How Does Short Selling Work?

- You don't own the shares, you borrow them from your broker.
- You must have a margin account (a special account with extra money as a safety buffer) usually 50%.
- If the price rises too much, you may get a margin call (broker asks you to add more money) usually 30% .
- You pay interest and any dividends to the broker while you hold the short position.

4. Comparing Long and Short Trading

Feature	**Long Trading**	**Short Trading**
Bet Direction	Price goes up	Price goes down
How to Profit	Buy low, sell high	Sell high, buy low

Maximum Loss	What you invested	Unlimited (if price rises)
Maximum Gain	Unlimited (if price rises)	Limited (if price falls to 0)
Special Risks	None	Margin calls, short squeeze

5. Extra Examples

Long Trade Example:

- You buy 100 shares of ABC at $20 ($2,000).
- Price rises to $30: You sell for $3,000. Profit = $1,000.
- Price falls to $10: You sell for $1,000. Loss = $1,000.

Short Trade Example:

- You short 50 shares of XYZ at $40 ($2,000 from sale).
- Price drops to $25: You buy back for $1,250. Profit = $750.
- Price rises to $60: You buy back for $3,000. Loss = $1,000.

6. Risks of Short Selling

- Unlimited Losses: If the stock price keeps rising, your losses can be huge.
- Margin Calls: Broker may ask for more money if your losses grow.
- Short Squeeze: If many people are short and the price jumps, everyone rushes to buy back, pushing the price even higher.
- Paying Dividends/Interest: You pay any dividends the stock issues and interest for borrowing shares.
- Buy-In Risk: Broker may force you to close your position early.

7. Why Do Investors Go Short?

- To profit from falling prices.
- To hedge (protect) other investments.
- To speculate on bad news or weak companies.

8. Summary Table: Long vs Short

Strategy	You Think Price Will...	You Do This	You Profit If...	You Lose If...
Long	Go up	Buy, then sell	Price goes up	Price goes down
Short	Go down	Sell, then buy	Price goes down	Price goes up

9. Real-Life Example: The Big Short

- In the movie "The Big Short," investors bet against the housing market by shorting mortgage-related assets.
- When the market crashed, they made huge profits because the prices fell sharply.

10. Key Takeaways

- Long trading is simple: buy low, sell high.
- Short trading is riskier: sell high, buy low, but losses can be unlimited.
- Always understand the risks before shorting a stock.

Example for Hedging :

Step-by-Step Example: Delta Hedging a Short Call Option

1. What does "short 100,000 call options" mean?

- Call option: Gives someone the right (but not the obligation) to buy a stock at a set price (the strike price) before a certain date.
- "Short" a call option: You have *sold* the call option to someone else. You collect a premium (money) now, but if the buyer exercises the option, you must sell them the stock at the strike price.

- Selling a call option (also called "writing" a call option) means you are creating an agreement with someone else, giving them the right to buy a specific stock from you at a fixed price (called the *strike price*) before a certain date.
- Your risk: If the stock price goes way up, you could lose a lot, because you have to sell the stock cheaply to the option holder.

2. What is Delta?

- Delta measures how much the price of an option changes if the stock price changes by $1.
- For a call option, Delta is between 0 and 1. If Delta is 0.5, the option price goes up $0.50 for every $1 increase in the stock price.
- If you are short (sold) the call, your position's Delta is negative.

Scenario

- You sell (short) 10 call options on Stock XYZ.
- Each option contract covers 100 shares (so, 10 × 100 = 1,000 shares total exposure).
- The current price of XYZ is $50.
- The delta of each call option is 0.6.

Step 1: Calculate Total Delta of Your Position

- Delta per call option: 0.6
- Total options sold: 10 contracts × 100 shares = 1,000 options
- Total position delta:
- Total Delta=Delta per option×Number of options=0.6×1,000=600
- Total Delta=Delta per option×Number of options=0.6×1,000=600
- Because you SOLD the calls, your position delta is negative:
- Total Delta=−600
- Total Delta=−600

Step 2: What Does This Mean?

- If the stock price goes up by $1, you lose $600 on your short call position.
- If the stock price goes down by $1, you gain $600.

Step 3: How to Hedge (Delta Neutralize) This Position?

- Shares of stock have delta = 1 per share.
- To offset your negative delta, you need to buy 600 shares:
- Shares to buy=600
- Shares to buy=600
- Now your total delta is:
- −600 (from options)+600 (from shares)=0
- −600 (from options)+600 (from shares)=0

Step 4: What Happens If the Stock Price Changes?

- If stock rises by $1:
    - You lose $600 on the short calls
    - You gain $600 on the shares
    - Net effect: $0
- If stock falls by $1:
    - You gain $600 on the short calls
    - You lose $600 on the shares
    - Net effect: $0

Step 5: What If Delta Changes?

- As time passes or the stock price moves, the delta of your options will change.
- Suppose after a week, the delta per option increases to 0.7 (maybe the stock price rose).
- New total delta:
- $-0.7 \times 1{,}000 = -700$
- $-0.7 \times 1{,}000 = -700$
- You now need to own 700 shares to stay delta neutral.
- Since you already own 600 shares, you need to buy 100 more shares.

Step 6: Dynamic Hedging

- You must keep adjusting your share position as the delta changes to stay hedged.
- This is called dynamic delta hedging.

Summary Table

Step	Option Delta	Total Option Delta	Shares Owned	Net Delta	Action

Initial	0.6	-600	600	0	Buy 600 shares
After Change	0.7	-700	700	0	Buy 100 shares

Key Takeaways

- Selling call options exposes you to risk if the stock price rises.
- Delta tells you how much your position will gain or lose for a $1 move in the stock.
- You can hedge this risk by buying shares to offset the negative delta.
- As delta changes, you must adjust your hedge (dynamic hedging) to stay protected.