Imperial College London

8 November 2025

What Are Options? The Intuition Behind Derivatives

Main Topics:

- The stock market
- What are derivatives and why they exist
- Call and put options: rights, obligations, and payoffs
- Visualising payoff diagrams
- Simple profit/loss examples

Imperial College London

The Stock Market — What & Why

- **What it is:** A marketplace (physical + electronic) where owners of financial *securities* meet buyers and sellers. (buy/sell shares they own with other people)
- **Why it exists:**
  - **Raise capital:** Firms issue shares/bonds to fund projects.
  - **Price discovery:** Continuous trading reveals consensus prices.
  - **Liquidity:** Investors can enter/exit positions quickly.
  - **Risk sharing:** Different investors take the risks they want.

Imperial College London

What Are Assets?

Definition:

- An **asset** is anything of value that provides future economic benefit.
- Assets = things that hold or produce value over time.

Security

A security is a tradable certificate that has monetary value.

Imperial College London

Types and Examples of Assets

Types of Assets:

- **Real assets:** tangible items such as real estate, gold, or equipment.
- **Financial assets:** claims on future cash flows, such as cash, stocks, or bonds.

Examples:

- Equities
- Fixed Income
- Cash
- Real assets

Imperial College London

Equities

What do we really mean by an equity?

Equity Definition

- **Equity** represents ownership in a company.
- Investors purchase equity in *public companies* through **shares** traded on an exchange.
- Each share is bought or sold at its **market value**.

Market Value

The price that investors are currently willing to pay to purchase an item, e.g. a security.

Question: *Where does the trading of shares take place?*

Imperial College London

Fixed Income

Definition

- Securities that offer **regular payments** to investors over a given time period are called **fixed income** securities.
- **Bonds** are a common example, typically traded *over-the-counter (OTC)*.

Imperial College London

Fixed Income - 2

Illustration: Lending to Bobby

- You lend Bobby £20,000 to buy a car at 1% interest over 5 years.
- Bobby pays £200 every year — this is the **fixed coupon rate**.
- After 5 years, Bobby repays the **principal** £20,000 — this is a **bond**.

Imperial College London

What Are Derivatives and Why Do They Exist?

Definition:

- A **derivative** is a financial instrument whose value depends on another asset (the *underlying asset*).
- Common examples: **forwards**, **futures**, **options**, and **swaps**.

Main Types of Derivatives and Examples

- **Forwards:** Private agreement to buy or sell an asset in the future at a set price.
  Example: A farmer agrees to sell wheat at £200/ton in 3 months.
- **Futures:** Standardised forwards traded on an exchange.
  Example: Buying an S&P 500 futures contract at 4,000 for next month.

Main Types of Derivatives and Examples - 2

- **Options:** Give the right, but not the obligation, to buy or sell an asset at a fixed price.
  Example: A call option on Apple stock at $200 strike expiring in 1 month.

- **Swaps:** Agreements to exchange cash flows, often to manage risk.
  Example: Firm A (fixed-rate loan) and Firm B (floating-rate (interest rate varies over time)) exchange interest payments.

Summary: Derivatives allow participants to hedge, speculate, or transform risk exposures.

Imperial College London

What Are Derivatives and Why Do They Exist? - 2

Why Derivatives Exist:

- **Hedging:** Protect against unwanted price movements (e.g., airlines hedging fuel costs).
- **Speculation:** Take positions on expected market moves.
- **Arbitrage:** Exploit price differences across markets.
- **Leverage:** Gain large exposure with smaller capital outlay.

Key Idea: Derivatives allow investors to *transfer, manage, or take on risk* linked to an underlying asset.

Imperial College London

Call and Put Options

What is an Option?

- An **option** gives the holder the *right, but not the obligation*, to buy or sell an asset at a fixed price (the **strike price**) on or before a certain date.
- The buyer pays a **premium** (the option price) to the seller for this right.
- You are betting on the price

Imperial College London

Call and Put Options - 2

Two Main Types:

- **Call Option:** The right to **buy** an asset at the strike price. *Example:* A call on Apple stock with strike \$100. If the market price rises to \$120, the holder buys at \$100 and gains \$20.

- **Put Option:** The right to **sell** an asset at the strike price. *Example:* A put on Apple stock with strike \$100. If the price falls to \$80, the holder sells at \$100 and gains \$20.

Key Idea:
Calls profit when prices **rise**; puts profit when prices **fall**.

Imperial College London

Why Options Are Riskier Than Buying Equities

Intuition:

- Buying a **stock** means owning part of a company — its value moves one-for-one with the share price.
- Buying an **option** is like a leveraged bet: you pay a small premium to control a large position.
- This leverage amplifies both potential gains and potential losses.

Imperial College London

Equity vs Option Return Comparison

Scenario Setup:

- Current stock price: £100
- Call option strike: £100
- Option premium: £5

Imperial College London

Example: Why Options Are Riskier Than Stocks

Case 1 – Stock Price Rises to £120

- **Stock:**
  Profit $= 120 - 100 = +20$
  Percentage return $= \frac{20}{100} = +20\%$
- **Call Option:**
  Option gives the right to buy at £100.
  Intrinsic value $= 120 - 100 = +20$
  Profit $= +20 - 5 = +15$ (you paid £5 premium)
  Percentage return $= \frac{15}{5} = 3 = +300\%$

So with only £5 invested, you earn £15 profit — that's three times your initial outlay → +300% return.

Imperial College London

Example: Why Options Are Riskier Than Stocks

Case 2 – Stock Price Falls to £90

- **Stock:**
  Profit $= 90 - 100 = -10$
  Percentage return $= \frac{-10}{100} = -10\%$
- **Call Option:**
  Stock is below the strike price (worthless at expiry).
  Profit $= 0 - 5 = -5$
  Percentage return $= \frac{-5}{5} = -100\%$

You lose your entire £5 premium $\rightarrow$ -100% return.

Imperial College London

Payoff Diagram: European Call Option

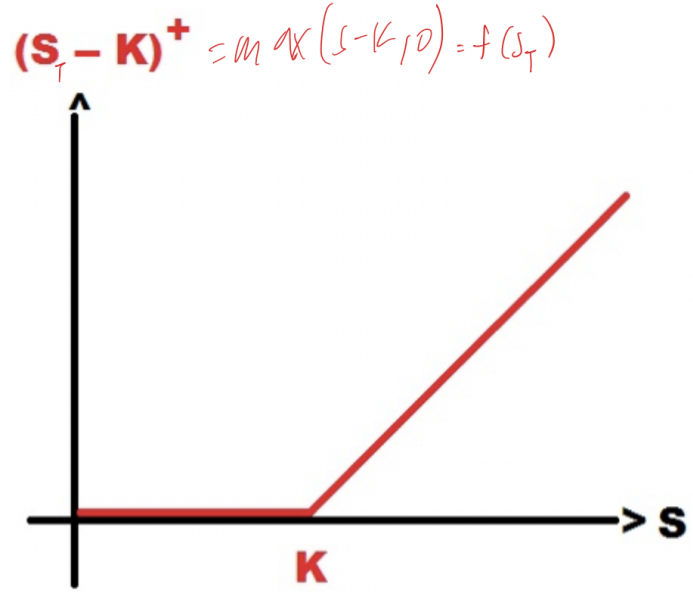

Figure 1: Call Option Pay off

Imperial College London

Payoff Diagram: European Put Option

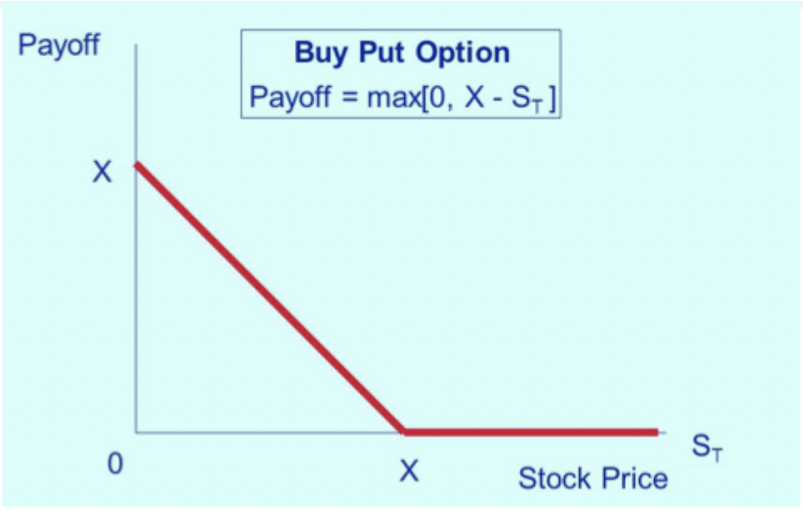

Figure 2: Put Option Pay off