



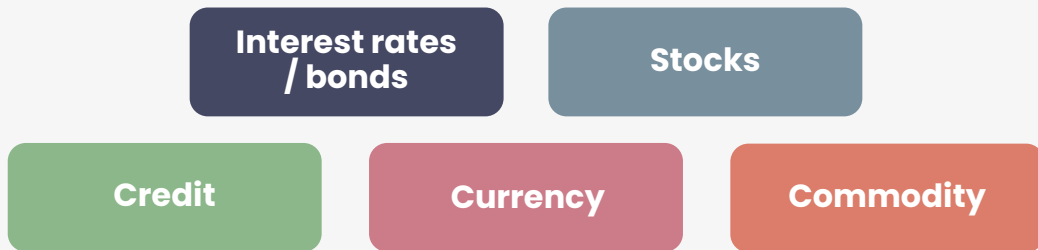
Introduction to Derivatives

What is a Financial Derivative?

A derivative is a type of **financial contract**

The **value** of the **contract** depends on the **price of the underlying**

Traditional Asset Classes



Market Factors



Global public equity market (2022)

\$101TN

Global public debt market (2022)

\$235TN

Global OTC derivatives notional amounts outstanding (2022)

\$618TN

Sources: 2023 Capital Markets Fact Book, Securities Industry and Financial Markets Association (SIFMA), July 2023, 2023 Global Debt Monitor, International Monetary Fund, September 2023, BIS OTC derivatives statistics Dec 2022

The Three Basic Types



Forwards and Futures

Agreements to **buy or sell** the underlying asset:

Settlement at pre-agreed future date

Price determined today

Futures are **forwards traded** on **organized exchanges**

A trader agrees to buy **10,000 barrels of oil** for settlement in **3 months** at an agreed upon price of **76.50 USD per barrel**



Swaps

Agreements to exchange **two streams** of cash flows:

Interest rate swaps

Credit default swaps

Equity swaps

FX swaps

Payments are exchanged at **regular intervals**

The payment stream fluctuates based on the underlying **asset's performance**

A trader agrees to pay a **fixed interest rate of 4% per annum** in exchange for **SOFR on 100 million USD over a five-year period**



Options

Gives the option **buyer** the **right to buy** (call) or **sell** (put) the underlying:

At a predetermined level (strike price)

At or before a specified date (expiry date) in the future

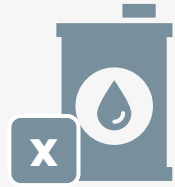
The **option seller** receives the **option premium**

A trader buys a **3 months call option** on a stock that trades at **\$100 in the spot market** with a **strike at \$105**

Link Between Underlying Price and Contract Value



Forward
executed



Purchase **10,000**
barrels of oil



Settlement date:
3 months



Forward price:
\$76.50 per barrel

At expiry date



Market price of oil
rose to **\$80 per barrel**



Locked in to buy at \$76.50,
\$3.50 **below** the **market rate**



Gain of \$3.50 per barrel or
\$35,000 total (10,000 barrels)



Price of oil dropped
to **\$73 per barrel**



Contracted to buy at \$76.50,
\$3.50 **above** the **market**



Loss of \$3.50 per barrel or
\$35,000 total (10,000 barrels)

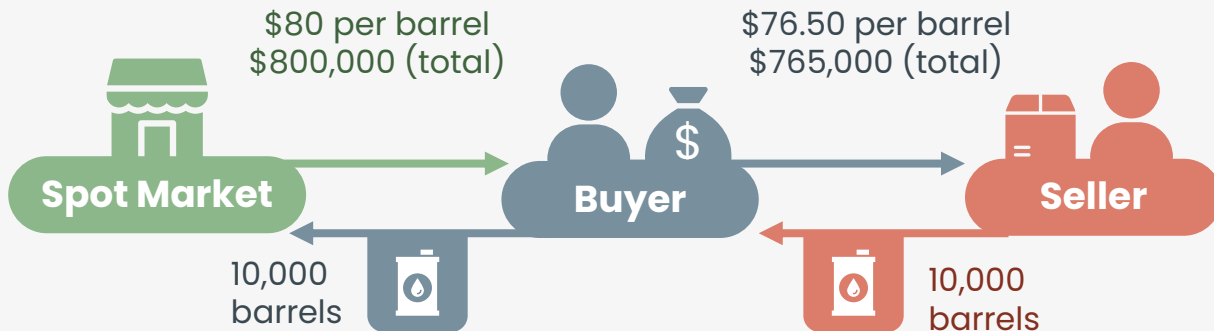
Cash vs. Physical Settlement



Physical Settlement

At expiry, the underlying is **delivered to the buyer** who in turn **must pay the agreed upon price**

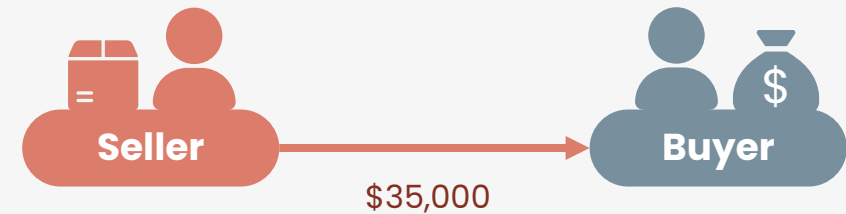
Trader pays \$765,000 and receives 10,000 barrels WTI



Cash Settlement

At expiry, the **economic value** of the contract is **paid/received**. No delivery of the underlying occurs

Trader receives the value of the contract at expiry which is \$35,000



Hedging vs. Speculation



Hedging

Purpose

Reduce or mitigate risk

Concept

Take a **position in the market** that is **opposite to an existing position** you want to hedge. Profits of the hedge should **offset losses** in the existing position



Speculation

Purpose

Create or increase **existing exposure** to **generate profits** from **expected price moves**

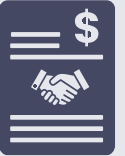
Concept

Buy or sell financial instruments with the expectation that their **value will change** favorably

Forward Definition



Forwards are the **agreement to buy (long)** or **sell (short)** the underlying at a **specified date in the future** (forward date) at a price agreed upon at the time of **trading (forward price)**



Example:

A trader agrees to buy 100M USD against EUR at an agreed upon price of 1.1029 for settlement in 3 months

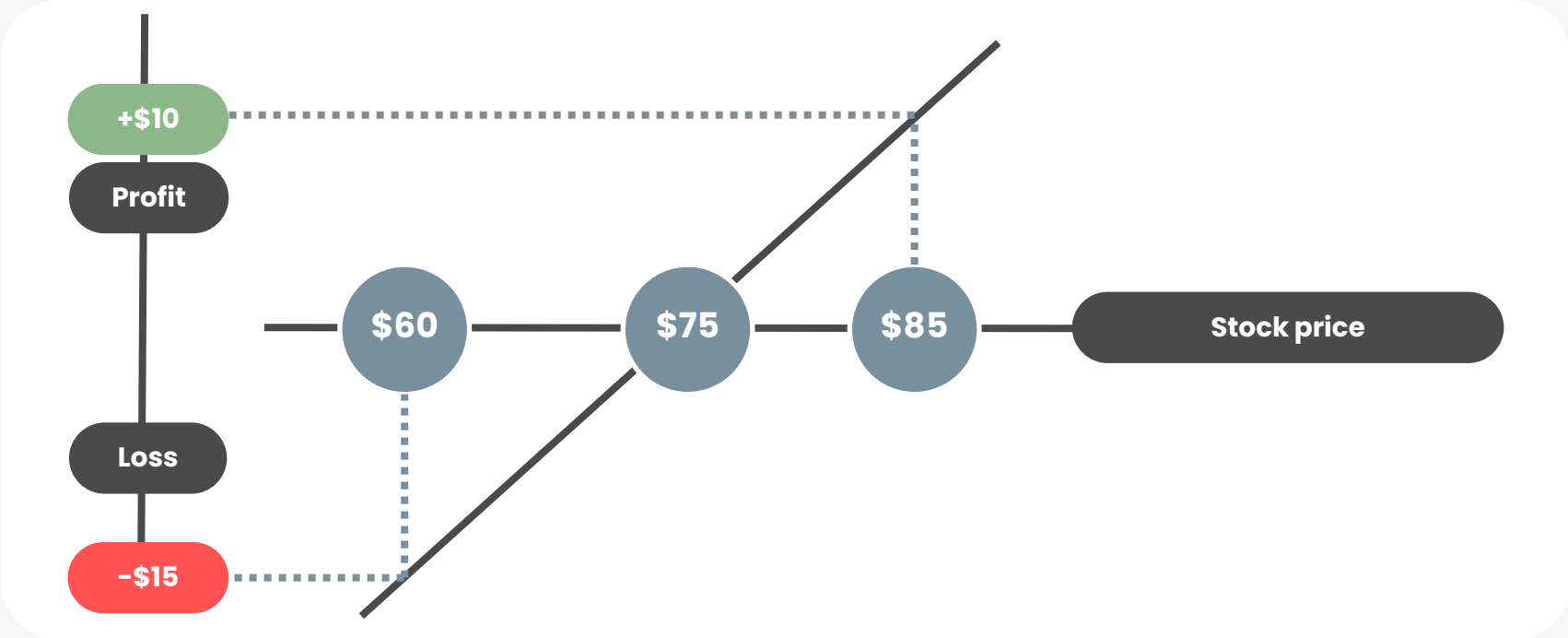


Long Forward Payoff Diagram

A client who's entered into an **equity forward contract** with a bank where the client has agreed to buy

1000 shares

\$75 in one year

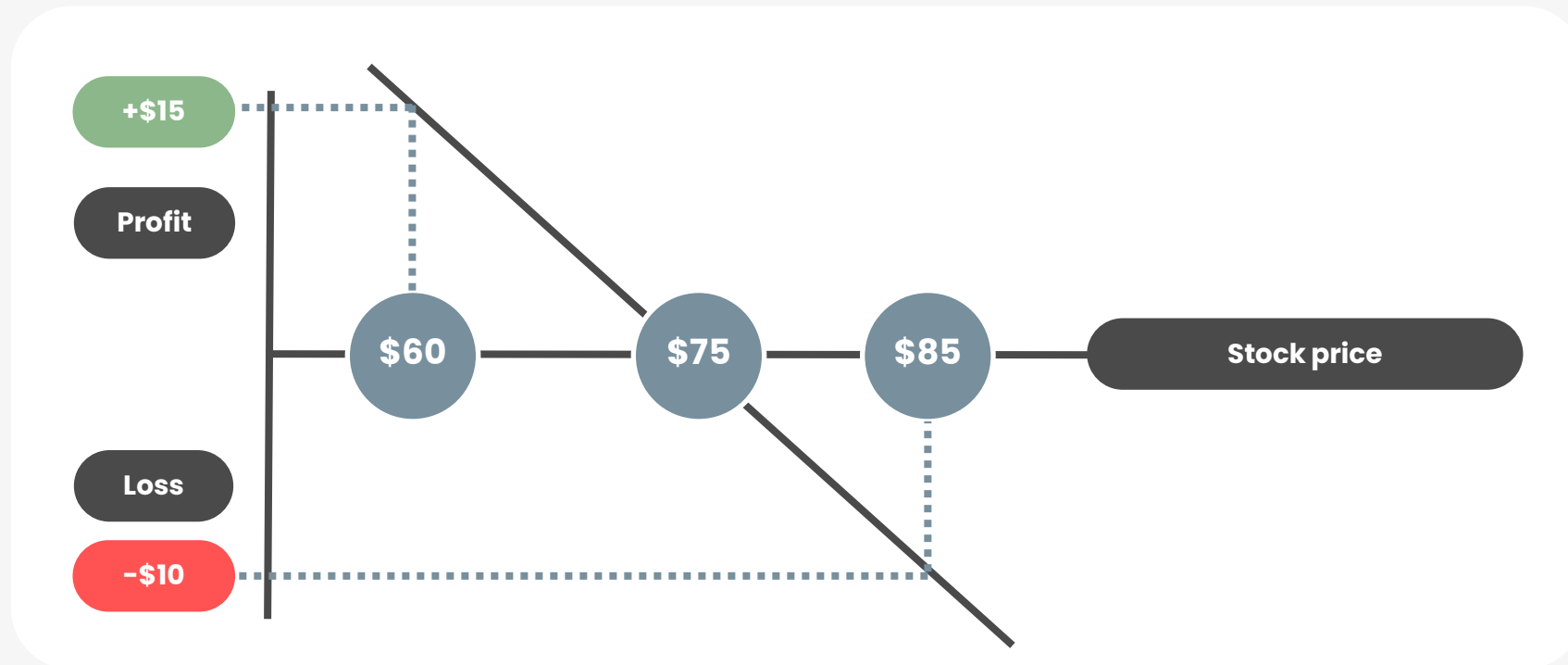


Short Forward Payoff Diagram

For the same trade the **bank's position** is that it will have to deliver:

1000 shares

\$75 in one year



The Forward Price

Assume you work as a market maker and have been asked to **quote a 12 months forward price**. Based on the information given below, what would be the **fair forward price**?

Spot price of the asset:

100

Analyst 12 months price target:

107

Your own expectation for the price of the asset in 12 months:

109

Client expectation for the price of the asset in 12 months:

115

12 months interest rate:

5%

The asset pays no dividends

From Spot To Forward – The Cost Of Carry

The fair forward price is based on no-arbitrage calculations

Fair forward price = spot price + net cost of carry

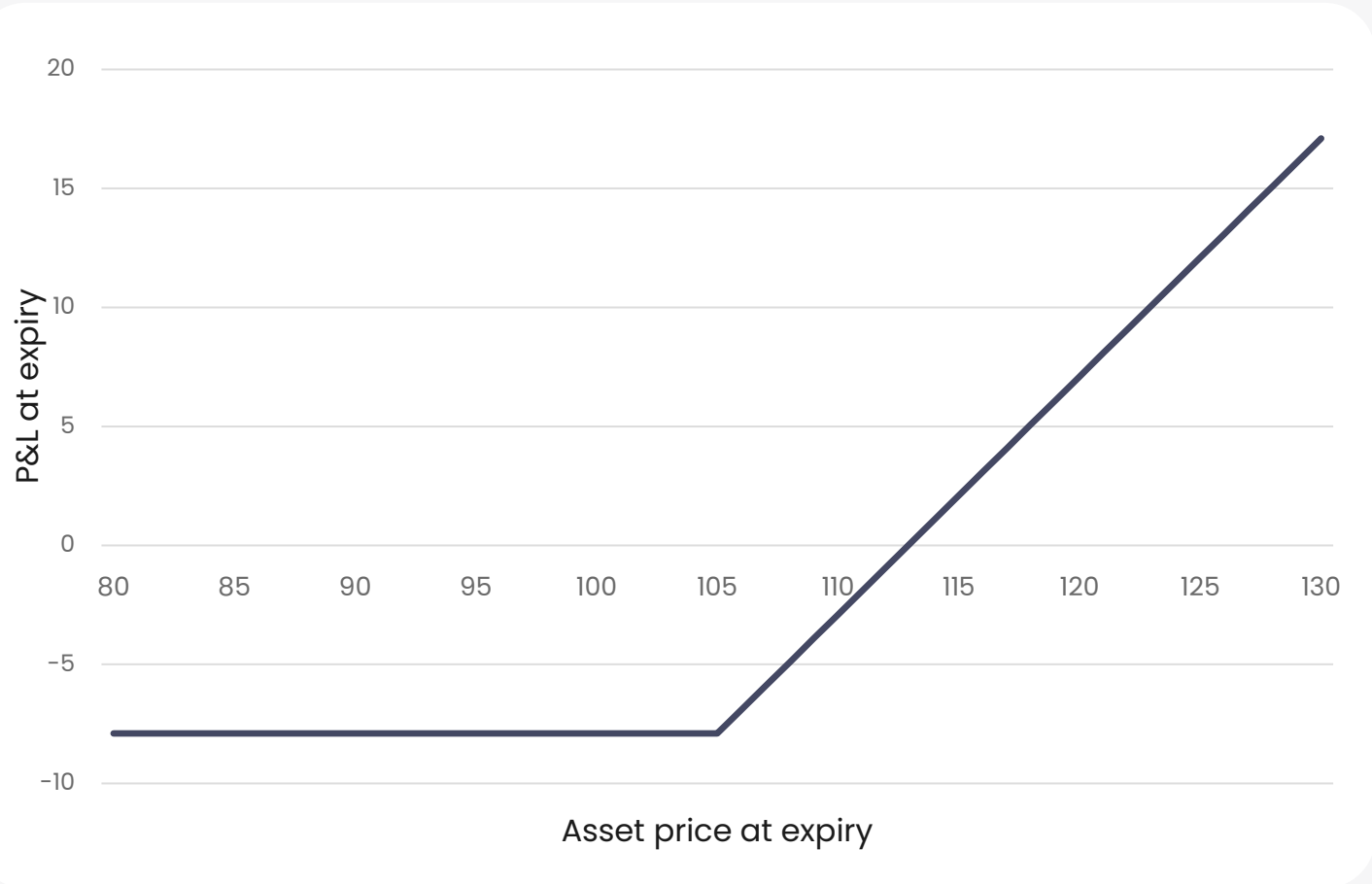


The cost of carry components differ depending on the nature of the asset:



| Underlying | Price increasing components | Price decreasing components |
|-------------|---|-------------------------------|
| Equity | Interest rate | Dividend |
| Bond | Interest rate | Accrued interest (coupon) |
| Currency | Interest rate (quoted currency) | Interest rate (base currency) |
| Commodities | Interest rate, storage costs, insurance, transportation, etc. | None |

Financial Options



Gives the option **buyer** the **right to buy** (call) or **sell** (put) the underlying:

At a predetermined level (strike price)

At or before a specified date (expiry date) in the future

Risks and opportunities **differ significantly**, to compensate for this asymmetry the **option buyer must pay the option premium**

Example:

12-month call option

\$105 strike price

Premium of \$7.90

The 4 General Option Positions

Long call



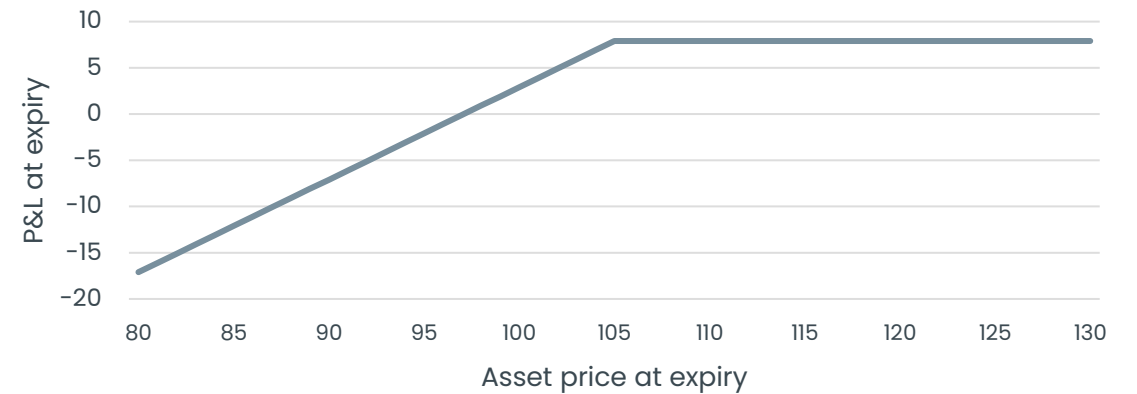
Long put



Short call



Short put



Option Moneyness



In the money (ITM)

Strike is favorable in comparison to the **current market price**

105 strike put when underlying trades at 90



At the money (ATM)

Strike equals current market price

105 strike call when underlying trades at 105



Out of the money (OTM)

Current market price is favorable in comparison to the **strike**

105 strike call when underlying trades at 90

Moneyness can be determined in reference to spot or forward price of the asset.
As spot and forward prices often differ, care must be taken:

Example:
12-month call option

Strike price

105

Spot price

100

Out of the money spot

Forward price

105

At the money forward



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