How Derivatives Work

Detailed Examples: Hedging, Speculation, and Swaps

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Example 1: Hedging with Options

- Scenario:
  - A U.S. firm expects to receive €1,000,000 in 90 days.
  - Revenue depends on EUR/USD exchange rate at conversion.
  - If euro weakens, firm receives fewer dollars.

Risk of Exchange Rate Movement

- Why risk exists:
  - Current spot = $1.10/€ → Expected $1,100,000 revenue.
  - If EUR falls to $1.00 → revenue drops to $1,000,000.
  - If EUR falls to $0.95 → revenue becomes $950,000.
  - Firm wants to avoid uncertainty.

Hedging Solution: Buy a Call Option

- Action:
  - Firm buys call option on $ at strike = $1.05/€.
  - This guarantees euro receipts can be exchanged at $1.05 minimum.
  - If market rate is better, firm ignores the option.
  - Provides protection while allowing upside gain.

Example 2: Speculation with Futures

- Scenario:
  - Euro futures for 1 year = $1.20/€.
  - You believe euro will rise to $1.32.
  - You buy euro futures now to profit from expected rise.

Speculation Payoff

- Outcomes:
  - If EUR = $1.32 → gain = $0.12 per € (10% profit).
  - If EUR = $1.20 → break even.
  - If EUR < $1.20 → loss equal to price decline.
  - Futures require commitment → no protection.

Example 3: Currency Swap

- Scenario:
  - Company A (U.S.) needs €1,000,000.
  - Company B (EU) needs $1,100,000.
  - Spot rate = $1.10/€.

How the Swap Works

- Steps:
  - Today: A gives $1,100,000 to B; B gives €1,000,000 to A.
  - In 1 year: They reverse the exchange at the same $1.10/€ rate.
  - This locks in rates and avoids currency risk.

Currency Swap: Cash Flows (Party A – U.S.)

Time	USD Cash Flow	EUR Cash Flow	Description
Today (T0)	-$1,100,000	+€1,000,000	Receive euros now; pay dollars at spot $1.10/€
In 12 months (T1)	+$1,100,000	-€1,000,000	Reverse exchange at agreed forward $1.10/€
Net (USD terms)	0 (locked)		Dollar amount is fully hedged by forward leg

Currency Swap: Cash Flows (Party B – Europe)

Time	USD Cash Flow	EUR Cash Flow	Description
Today (T0)	+$1,100,000	-€1,000,000	Receives dollars; delivers euros
In 12 months (T1)	-$1,100,000	+€1,000,000	Reverse exchange at $1.10/€

Valuation of Forward Leg at Maturity (Scenario Analysis)

Future Spot S(T1)	Market value of €1,000,000	Swap inflow (locked)	Gain/Loss vs Market
$1.20/€	$1,200,000	$1,100,000	-$100,000 (foregone upside)
$1.10/€	$1,100,000	$1,100,000	$0 (at-the-money)
$1.00/€	$1,000,000	$1,100,000	+$100,000 (protection benefit)

Why a Currency Swap = Spot + Forward

- A plain-vanilla currency swap combines:
- • A spot exchange today (swap the notionals)
- • A forward contract to reverse the exchange at a fixed rate on a future date
- • Hence, total FX exposure is neutral: the future rate is locked; only counterparty risk remains
- Forward rate intuition (covered interest parity): $F = S \times (1 + r_{USD}) / (1 + r_{EUR})$
- In practice, F is set so neither side has