1 Payoff_vanilla_asian.py

Purpose

Demonstrates the difference between a **vanilla European call** (payout based on spot price at expiry) and an **Asian call** (payout based on the average spot price during the life of the option).

Learning focus

- A vanilla call payoff is $max(S_T - K, 0)$, where only the final spot price matters.
- An Asian call payoff is $max(\bar{S} - K, 0)$, where $\bar{S}$ is the average over time.
- Averaging smooths out price fluctuations, reducing volatility in the payoff — and generally lowering its value compared to the vanilla option.

Key intuition

Asian options are less sensitive to short-term spikes in spot price. This makes them **cheaper** but also **less risky** than vanilla calls, which is why commodity firms often use them for hedging when daily price swings are volatile but temporary.

Experiment

Increase sigma (volatility) and see how much the vanilla payoff jumps relative to the Asian payoff. This shows the dampening effect of averaging.

2 asian_option_vs_volatility.py

Purpose

Quantifies how **implied volatility** affects the price and **Vega** (vol sensitivity) of Asian and vanilla calls.

Learning focus

- Vanilla calls have higher Vega — their value rises more when volatility increases.
- Asian calls, because of averaging, **dilute volatility exposure**.
- Lower Vega means less potential upside from vol spikes, but also less downside if vol collapses.

Key intuition

If you're a trader expecting a big volatility move, vanilla calls give you more exposure. If you're hedging exposure and want to avoid overpaying for vol risk, Asian options can be a smarter structure.

Experiment

Run the script with volatility ranging up to 1.0 (100%) and compare the price curves. You'll see the gap between vanilla and Asian widening as volatility increases.

3 MC_average_vs_spot.py

Purpose

Uses Monte Carlo simulation to show **how the average price path behaves compared to the spot price path**.

Learning focus

- The average price **lags** behind sharp spot price moves.
- Spikes in spot are **smoothed** in the average, and over time the average converges to a stable value.
- This lag is exactly why Asian option payoffs are typically lower — the averaging process dampens the effect of temporary extreme moves.

Key intuition

For short-term traders, spot price swings can create big P&L jumps. For long-term hedgers using an average-based payoff, those swings are muted, which can be good for risk control.

Experiment

Reduce the number of paths (n_{paths}) to 3 and visually track one path's spot vs. average — you'll clearly see the average "chasing" the spot but never quite catching the peaks or troughs.