# Coffee C® Futures & Options: Quantitative Risk Report

## # The Integrated Market Outlook

This report synthesizes three distinct quantitative layers to evaluate the six-month horizon for Coffee C® futures and options. By bridging the gap between theoretical fair value and stochastic forecasting, we provide a clear view of the market's "expected gravity" versus its "extreme risk potential."

## # Summary of Key Metrics ( The "Results")

| Project Component | Key Metric | Interpretation |
|---|---|---|
| Project 1: Cost of Carry | $3.01 | The "No-Arbitrage" future price based on holding costs. |
| Project 2: Black Schole Model | $0.34 | The cost of time and market volatility (The Hedge). |
| Project 3: M C Simulation | $3.04 | The expected "Center of Gravity" across 10,000 scenarios. |

## # Visual Proof (The "Evidence")

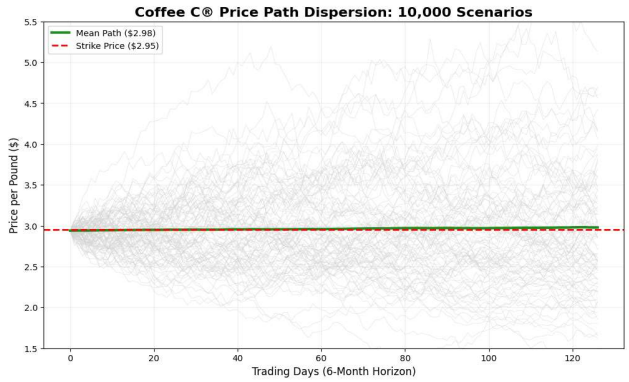


*Figure 1: Price Path Dispersion (The Journey)*

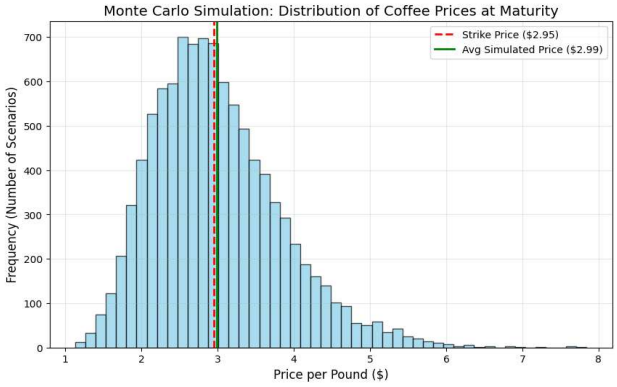


*Figure 2: Terminal Price Distribution (The Destination)*

**Integrated Risk Analysis**

The dual-lens view above provides a comprehensive 'stress test' of our strategy. **Figure 1** illustrates the 'Fan of Uncertainty' over the 126-day trading horizon, visualizing the 10,000 unique paths the market could take. While the paths appear chaotic, **Figure 2** settles this noise into a clear statistical distribution at maturity.

Together, they prove that while the market's center of gravity is near our fair value, the **upside risk (the 'fat tails' in Fig 2)** is significant. This confirms that our **$0.34 premium** is a vital insurance policy to protect our procurement budget against the extreme price spikes seen in **Fig 1**.

## # Strategic Recommendations (The "Action")

**1. Risk Mitigation:** Given the high volatility (**39.30%**), the **$0.34 premium** is a reasonable "insurance policy" to cap procurement costs at **$2.95**.

**2. Arbitrage Monitoring:** If the market price for 6-month futures trades significantly higher than **$3.01**, it indicates an "overpriced" scenario where selling futures could be profitable.

**3. Dynamic Updating:** These models should be refreshed weekly to account for **Time Decay (Theta)** and shifting volatility levels.

## # Technical Appendix (The "How")

**The Hybrid Quantitative Workflow**

**1. Excel as the "Control Center":** Used for initial data ingestion, Cost of Carry calculations, and Black-Scholes closed-form solutions.

**2. Python as the "Stress Test Engine":** Used to execute **10,000 Monte Carlo iterations** to provide a high-fidelity statistical check on the static Excel models.

**Model Specifications**

**1. Stochastic Process:** The simulation utilizes **Geometric Brownian Motion (GBM)**, assuming coffee price returns are log-normally distributed.

**2. Volatility Calibration:** Annualized volatility (sigma) is dynamically calculated in Python: sigma = STDEV(Log Returns) * sqrt(252).

**3. Time Step Logic:** I utilized a time step (dt) of T/252, simulating exactly 126 trading days (T=0.5).

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This model bridges the gap between the coffee warehouse and the trading floor. It ensures our buying strategy is based on actual logistics, while our insurance (the option) is backed by 10,000 simulations. We've turned market uncertainty into a manageable plan.