The Week 2 Deep Dives cover options. Start with an advanced model for pricing American options with kurtosis and skew. Build a stock price simulation and forecast volatility and compute realized volatility.

Edgeworth model for binomial options pricing

Instead of specifying the entire risk-neutral distribution by the riskless return and volatility (as in the Black-Scholes case), this distribution is specified by its third and fourth central moments as well.

EdgeworthBinomialOptions.ipynb 27.14 KB
EdgeworthBinomialOptions.pdf 191.48 KB

Use GARCH to find options mispricings

Professional options traders don't make bets that stocks will go up or down. They look for mispricings in the market. Mispricing happens when the market price is different than what a model says the price should be.

If the price of an option is $1.50 and the model shows it should be $1.75, a trader would buy the option "cheap" and wait for it to rise to $1.75.

Derivatives models use volatility to determine the value. So quants spend most of their time building the best volatility forecasts they can to find market mispricings.

GARCH.ipynb 171.41 KB

The 6 types of realized volatility

Statistical volatility (also called historic or realized volatility) is a measurement of how much the price or returns of stock value. It’s used to optimize portfolios, detect regime changes, and price derivatives. The most common way to measure statistical volatility is the standard deviation.

Unfortunately, there are some downsides to using standard deviation that most people don’t consider.

RealizedVolatilityModels.ipynb 335.82 KB

Use volatility cones to summarize realized volatility

The hardest part of options trading is determining if they are cheap or expensive. Whether you buy or sell an option, you’re exposed to the volatility of the underlying. That’s why it’s important to compare volatility to its recent levels.

Volatility cones can help you do this.

VolatilityCones.ipynb 110.63 KB

Simulate stock prices with Geometric Brownian motion

Brownian motion comes from physics. It describes the random movement of particles in a substance. A Wiener process is a one-dimensional Brownian motion. It's named after Norbert Wiener who won a Nobel Prize studying one-dimensional Brownian motions.

The Wiener process features prominently in quantitative finance because of some useful mathematical properties.

Geometric Brownian motion is a continuous-time stochastic process where the log of the random variable follows the Wiener process *with drift*.

GeometricBrownianMotion.ipynb 198.13 KB