

Project 3 – Selling Volatility

How did we extract the premium?

To extract the premium and manage a delta-neutral portfolio, we implemented a strategy based on the Black-Scholes model and historical simulation. The goal was to create a portfolio that generates returns when realized volatility is lower than implied volatility, while ensuring that the portfolio's 1-day 95% VaR does not exceed 1 million DKK in the first day.

We calculated implied volatilities for call and put options using the Black-Scholes model and a bisection method. The simulated returns from the historical simulation represents the realized volatility of the market index. A straddle is created by taking a short position in call and put options with the same time to maturity (16th of May) and the same strike price (1600 DKK). If Realized Volatility < Implied Volatility the options are overpriced so the portfolio sells options (collecting premium) and hedges delta. If the underlying asset moves less than expected (low realized volatility), the options expire worthless or lose value slowly, allowing the strategy to retain most of the premium. By dynamically hedging delta with futures, we try to eliminate risk of fluctuations in the market index, so profit comes purely from $IV > \text{realized volatility}$.

How much lower is the volatility of the portfolio after the hedge:

The portfolio is only built by derivatives on the Danish market index. This implies that the volatility of the portfolio is closely related to how the portfolio value changes with fluctuations of the market index. The delta of the portfolio before the hedge was:

0,195, -49546,671, 38922,973, -65805,383, 9558,661, 30001,195

for each day respectively. Meanwhile, the delta of the portfolio after the hedge was:

0,195, -46,671, 22,973, -5,383, -41,339, 1,195

As shown, the hedge resulted in a drastic decrease in the delta each day it was executed. A low delta of the portfolio implies that fluctuation in the underlying asset only results in small changes in the portfolio value. Therefore, by hedging and lowering the delta, we have lowered the volatility of the portfolio.

Reflection:

This project was challenging but very interesting. It was a challenge to find some of the required values, but when all values were found it was more straightforward. It was interesting to learn more about an option strategy and to receive insights in how it can be executed in real life.