Financial Computation & Simulation
Project Milestone 1
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Performance Goals and Metrics

Strategy

Our group decided to use a Delta-Gamma strategy to hedge our portfolio. Delta is a metric used to measure the sensitivity of an option relative to the price of the underlying. The two main factors that affect delta is distance of the price of the underlying to the strike price, the time to expiration of the option. Gamma is measured as the second derivative with respect to the price of the underlying or the first derivative of delta.

As we all know in the financial field, Delta-hedging means selling or buying derivatives in order to hedge against the underlyings that you have shorted or held. Therefore, our total investment portfolio would be incrementally Delta neutral, which means that there will be no profit or loss in the case of small changes in the spot price. Basically, the disadvantage of Delta-Hedging is that people cannot continue hedging based on Black-Shcoles Model.

In real life, there will always be some transaction costs, which means the final profit and loss will be close to zero. However, another risk of Delta-Hedging is that when the underlying price is closed to strike price during the few days before maturity date, in such case, it would be hard to hedge, since the first derivative of Delta (Gamma) would be great, and final loss would be great too. In other words, when the date is close to the maturity date, the Delta is more sensitive to spot price, which makes Delta-Hedging more difficult. In this case, Gamma-hedging is recommended, which is an important part of our Delta-Gamma strategy.

Since our portfolio is self-funding, our portfolio will be required to sell options and collect premiums at inception.

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Since the portfolio has an imposed risk limit of depreciation no more than 3% over the course of a 10-day period, **Value-at-Risk (VaR)** will be one of the metrics used to evaluate the expected performance of our portfolio.

We will also use the **Sharpe Ratio** to assess the performance of our portfolio. This ratio is calculated using the return of the portfolio, the return using the risk free rate, and the standard deviation of the excess return. The reason why this metric is a good choice is that it accounts for additional risk taken beyond simply using the risk free rate.

Data

Our data will be pulled through the **quantmod** R library. Specifically, we are interested in the adjusted prices which are found in the last column. The adjusted stock prices represent a more accurate value of the stock at closing, since they adjust for corporate actions such as stock splits and dividends.

Our data will also in part be pulled from the **ustyc** R library, which accesses the daily Treasury yield curve rates and will be used in determining forward rates.