HEDGING PROJECT

Hedging is an important aspect of portfolio management. Portfolio managers are often required to stay within risk limits; for example, they cannot let their volatility be to high or value-at-risk so low. Also, there are times when market conditions lead them to reduce the risk of their portfolio. Hedging is the primary mechanism through which they carry out these tasks. Below, we give a mathematical statement of the hedging problem, ideas on how to start this project, and longer term opened ended questions that you can investigate if interested.

1. Statement of the Hedging Problem

Consider a portfolio that has daily prices p_i for $i = 1, \ldots, n$. Suppose you have selected a set of m hedging securities with prices p_i^j for $j = 1, \ldots, m$, and consider the hedged portfolio whose daily price is

$$h_i = p_i + \sum_{j=1}^{m} c_j p_i^j, \tag{1}$$

where here c_j are weights defining the amount of hedging securities that we will hold. Hedging is the process of selecting the hedging securities and associated weights c_j in order to minimize a given risk metric of interest, e.g. the volatility of the portfolio, the VaR, CVaR, etc.

2. Project Ideas

Getting Started:

– Start by implementing the minimum variance hedge (see attached slides for a definition) for a single stock (say IBM) and a market ETF (say the SPY ETF). You should be able to get end of day data from google finance and using the pandas datareader.

– After designing an initial hedging strategy, develop analytics to examine how significantly your hedged portfolio reduces or increases several standard risk and performance metrics of the original portfolio including the volatility, return, Sharpe Ratio, maximum drawdown, value-at-risk, beta of the portfolio to the market, etc.

– Investigate other hedging strategies besides the minimum variance hedge. For example, how can you try to minimize the variance of the return distribution, VaR, CVaR? This will lead into optimization methods many of which are available in scipy.

Further Ideas:

– Construct long/short portfolios of stocks in a given sector, e.g. financials, biotech, as well as a set of hedging securities for this sector. How should you adapt your single stock/hedging security approach to this case?

– Consider a fixed income portfolio that consists of corporate bonds. What are the appropriate hedging securities for this portfolio? Can you get as significant risk reductions as you saw in the equity case in this example?

– It is often said that gold is a hedge against inflation. Can you quantify this? For example, assume that inflation (year on year CPI) is tradeable and try to hedge it with gold futures. Can you get as good of hedging performance as in the equity examples that you considered? Can you find other futures, bonds, or stocks that are better hedges for inflation than gold?