STA 2503 Project - 2 <u>Dynamic Hedging</u>

In this project you will investigate Delta-Gamma hedging within the Black-Scholes model.

You have believe that an asset price process $S = (S_t)_{t\geq 0}$ follows the Black-Scholes model. It's current price is 100, you have just sold an at-the-money $\frac{1}{4}$ year put on this asset, and you wish to hedge it.

You may trade in an at-the-money put with maturity $\frac{1}{2}$ year, the stock, and the bank account. As well, you will account for transaction costs by assuming you are charged $2.5bp$ on equity transactions and $10bp$ on option transactions.

The remaining model parameters are

$$\mu = 10\%, \qquad \sigma = 20\%, \qquad \text{and} \qquad r = 2\%$$

and you hedge on a daily basis.

1. Compare the move-based with the time-based hedging strategy with Delta hedging.

2. ~~Compare the move-based with the time-based hedging strategy with Delta-Gamma hedging.~~

3. Investigate the role that the rebalancing-band in Delta plays on the hedge.

4. Suppose that the real-world $\mathbb{P}$ volatility is $\sigma \in \{10\%, 15\%, \ldots, 30\%\}$, but you still sold the option for the original price, and hedge assuming that volatility is 20%. Compare again, move and time-based hedging with Delta and Delta-Gamma hedging.

Comment on any observations.