Homework: efficient delta hedging with transaction costs

Objective: Suppose you are delta-hedging 1Y at-the-money call option which you purchased at an implied volatility of 0.2 and you believe (rightly) the actual volatility is 0.23. Assume the initial stock price is 100 and interest rates/dividends are both zero. Simulate 10,000 paths wtih 1,000 steps for the underlying instrument in a Monte Carlo experiment and answer the following questions:

1. What is the expected value of your P/L and its standard deviation assuming portfolio re-balancing to net zero-delta occurs at every step (5 points)?

2. If each trade in the underlying stock costs 0.1%, which would be more efficient (5 points each):

   (a) reducing the number of rehedgings from 1,000 to 100 (equally spaced); or

(b) reducing the number of rehedgings from 1,000 to 10 (equally spaced); or

(c) adopting a trigger-based rehedging strategy whereby portfolio is rebalanced only if delta changes by 5 percentage points.

Base your judgment on the analysis of P/L distributions (histograms) and the associated expected values and standard deviations. The superior outcome is one which delivers highest expected P/L with lowest standard deviation.

Deadline: Homework reports will be collected in hard copy on Jan 10 lecture. Neither late nor early submissions will be considered.