

HW9

1. Ideas outline:

In empirical simulation, we could use sampling to approximate the transition of order by Markov property. We could first denote with some probability at time t that one would receive an order, in which some for limit order some for market order. Under some further setup, we expect to have the limit buy, limit sell, buy order, sell order come with an probability of $1/4$. Also build the assumption that the limit order is normally distributed with mean equal of the ask price and variance of the spread.

2. Ideas outline:

LPT –

$$P_{t+1} = P_t \cdot e^{Z_t}$$

$$X_{t+1} = \rho \cdot X_t + \eta_t$$

$$Q_t = P_t \cdot (1 - \beta \cdot N_t - \theta \cdot X_t)$$

Assuming there's no risk-aversion, the objective is to maximize the Expected Total Sales Proceeds over the finite horizon up to time T .

$$V_t^*(P_t, R_t)$$

$$= \max_{\pi} \{V_t^{\pi}(P_t, R_t)\}$$

$$= \max_{\pi} \mathbb{E} \left(\sum_{i=t}^{T-1} N_i P_i (1 - \beta N_i - \theta X_i) \mid (t, P_t, R_t) \right)$$

From here, we could then solve from backwards for optimization solution.