1 Connection between resiliencies in OW model and our time series model.

Here:

- The trader has to buy $\mathbf{X_0}$ units of a security over a fixed time period $[0, T]$. x_{t_n} — the trade size at t_n. $X_{t_n} :=$
- B_{t_n} and A_{t_n} — bid and ask prices at t_n. $V_{t_n} = \frac{A_{t_n}+B_{t_n}}{2}$ — the mid-quote price; s — the bid–ask spread.
- F_t — the fundamental value of the security.
- $D_k = A_k - V_k - \frac{s}{2}$ — the deviation of current ask price A_t from its steady state level.

From the definitions of model:

$$A_t = V_t + \frac{s}{2} + x_0 \kappa e^{-\rho t}$$

$$D_{k+1} - D_k = -\rho D_k \Delta t_{k+1} + \alpha x_{k+1}$$

$$\Delta t_{k+1} := t_{k+1} - t_k, \qquad D_k := D_{t_k}, \qquad x_k := x_{t_k}, \qquad \Delta D_{k+1} := D_{k+1} - D_k.$$

$$V_{k+1} - V_k = \lambda x_{k+1} \to \Delta D_{k+1} = \Delta A_{k+1} - \lambda x_k$$

$$\frac{\Delta D_{k+1}}{\Delta t_{k+1}} = -\rho D_k + \alpha \frac{x_{k+1}}{\Delta t_{k+1}}$$

$$\frac{\Delta D_{k+2}}{\Delta t_{k+2}} - \frac{\Delta D_{k+1}}{\Delta t_{k+1}} = -\rho \Delta D_{k+1} + \alpha \left(\frac{x_{k+2}}{\Delta t_{k+2}} - \frac{x_{k+1}}{\Delta t_{k+1}}\right)$$

$$\frac{\Delta A_{k+2}}{\Delta t_{k+2}} - \frac{\Delta A_{k+1}}{\Delta t_{k+1}} = -\rho \Delta A_{k+1} + \rho \lambda x_{k+1} + (\alpha + \lambda)\left(\frac{x_{k+2}}{\Delta t_{k+2}} - \frac{x_{k+1}}{\Delta t_{k+1}}\right)$$