Further work on SPMSFv2

January 3, 2022

1 Next steps for the dynamical system

1.1 Eigenvalue analysis

Consider the dynamical system found in the initial analysis that optimized the following equation:

$$\hat{\theta} = \underset{\theta}{\text{argmin}} ||\hat{c}(o_0, h_0, l_0, c_0) - c|| \tag{1}$$

The best solution found was:

$$\begin{aligned} \hat{o}_{i+1} &= \theta_1 o_i + \theta_2 h_i + \theta_3 l_i \\ \hat{h}_{i+1} &= \theta_4 o_i + \theta_5 h_i + \theta_6 l_i \\ \hat{l}_{i+1} &= \theta_7 o_i + \theta_8 h_i + \theta_9 l_i \\ \hat{c}_{i+1} &= \theta_{10} o_i + \theta_{11} h_i + \theta_{12} l_i \end{aligned} \tag{2}$$

First note that the next states $\hat{o}_{i+1}, \hat{h}_{i+1}, \hat{l}_{i+1}, \hat{c}_{i+1}$ depend only on the previously predicted opening, high and low prices. o_i, h_i, l_i.

We will define a matrix A, where the values of A correspond to the best found values for parameters predicting the next opening, high and low prices of the NIO stock.

$$A = \begin{bmatrix} \theta_1 & \theta_2 & \theta_3 \\ \theta_4 & \theta_5 & \theta_6 \\ \theta_7 & \theta_8 & \theta_9 \end{bmatrix} = \begin{bmatrix} -0.00821929 & 0.00648149 & -0.06751814 \\ 0.037734 & -0.00305348 & 0.01541747 \\ 0.04340112 & 0.00234059 & -0.00903388 \end{bmatrix} \tag{3}$$

The eigenvalues of A are:

$$\begin{aligned} \lambda_1 &= -0.00863085 + 0.05147413j \\ \lambda_2 &= -0.00863085 - 0.05147413j \\ \lambda_3 &= -0.00304495 \end{aligned} \tag{4}$$

First, note that λ_1 and λ_2 are complex conjugates. These complex eigenvalues validate the sinusoidal nature of the graph.