

**HMM for stock exchange prediction** For each week, we measure the price movement relative to the previous week and denote it using a binary variable (+1 indicates up and 1 indicates down). The price movements from week 1 (the week of January 5) to week 39 (the week of September 28) are recorded in sp500.mat. Consider a Hidden Markov Model in which  $x_t$  denotes the economic state (good or bad) of week t and  $y_t$  denotes the price movement (up or down) of the SP500 index. We assume that

$$\begin{aligned} x_{(t+1)} &= x_t \text{ with probability } 0.8 \\ P_{(Y_t|X_t)}(y_t = +1|x_t = \text{good}) &= P_{(Y_t|X_t)}(y_t = 1|x_t = \text{bad}) = q \\ P_{(X_1)}(x_1 = \text{bad}) &= 0.8 \end{aligned}$$

We plot  $P_{(X_t|Y)}(x_t = \text{good}|y)$  for  $t = 1, 2, \dots, 39$  for  $q = 0.7$  and  $q = 0.9$ .