

## Advertising Strategy

A firm is planning its advertising strategy for a period of four weeks. In each week the sales level will be either *High* or Low and the firm will receive profits on sales of \$800 or \$600, respectively.

If the sales were High in the previous week then there is a 60% chance that sales will be High again in the current week if they do not advertise in the current week or 80% if they do advertise. If the sales were Low in the previous week then there is a 20% chance that sales will be High in the current week if they do not advertise in the current week or 60% if they do advertise.

The cost of advertising in one week is \$70. An extra cost of \$80 is incurred if the level of sales (and thus production) is changed from one week to the next.

What advertising strategy should the firm pursue?

Data  $p_{sa}$  prob of high sales if sales were  $s$  and we take action  $a$ .

$r_s$  revenue if sales are  $s$  (\$)

$c$  cost of changing production (\$)

$d$  cost of advertising (\$)

Stages Weeks  $t \in \{1, 2, 3, 4\}$

State Sales level in previous week  $s_t \in \{H, L\}$

Actions Advertise or not,  $a_t \in \{Y, N\}$

Value Function

$V_t(s_t) =$  maximum expected profit from weeks  $t, \dots, 4$  if we had sales  $s_t$  in previous week.

we want  $V_1(s_1)$  for  $s_1 \in \{H, L\}$ .

$$V_5(s_5) = 0$$

$$V_t(H) = \max \begin{cases} p_{HY}(r_H - d + V_{t+1}(H)) + (1 - p_{HY})(r_L - d - c + V_{t+1}(L)), & \text{if } Y \\ p_{HN}(r_H + V_{t+1}(H)) + (1 - p_{HN})(r_L - c + V_{t+1}(L)), & \text{if } N \end{cases}$$

$$V_t(L) = \dots$$