Q13.2 Friberg: Managing risk and uncertainty
a) Profit maximization problems of the two firms:

$$\max_{p_1} \left(A - p_1 + \frac{p_2}{2}\right)(p_1 - c_1)$$

$$\max_{p_2} \left(A - p_2 + \frac{p_1}{2}\right)(p_2 - c_2)$$

reaction function for firm 1

$$\begin{aligned} \frac{\partial \Pi_1}{\partial p_1} &= A - 2p_1 + \frac{1}{2}p_2 + c_1 = 0 \\ p_1 &= \frac{A + p_2/2 + c_1}{2} \end{aligned}$$

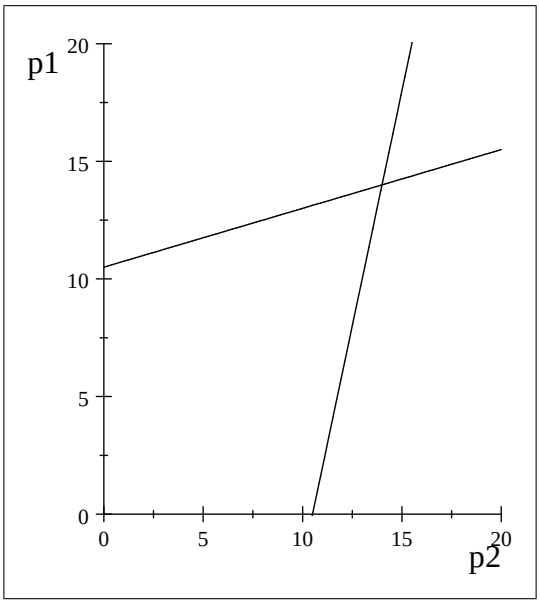
and reaction function for firm 2 :

$$\begin{aligned} \frac{\partial \Pi_2}{\partial p_2} &= A - 2p_2 + \frac{1}{2}p_1 + c_2 = 0 \\ p_2 &= \frac{A + p_1/2 + c_2}{2} \end{aligned}$$

To draw them in the same graph we rewrite the reaction function for firm 2 as

$$p_1 = -2A + 4p_2 - 2c_2.$$

To draw them we need to make assumptions on the parameters: $A = 19$, $c_1 = 2$, $c_2 = 2$. The flatter curve is the reaction function for firm 1.

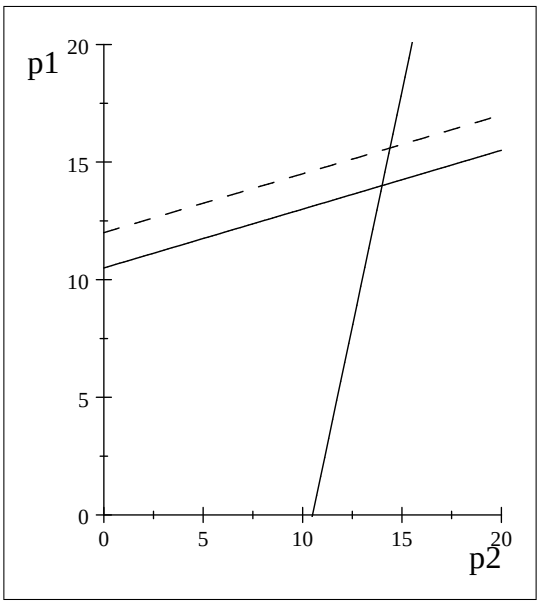


Equilibrium prices are given by solving the system:

$$\begin{aligned} p_1 &= \frac{A + p_2/2 + c_1}{2} \\ p_2 &= \frac{A + p_1/2 + c_2}{2} \end{aligned}$$

with $p_1 = 14$ and $p_2 = 14$ for these values of A, c_1 and c_2.

b) If $c_1 = 5$ firm 1's reaction function shifts to the dashed line.

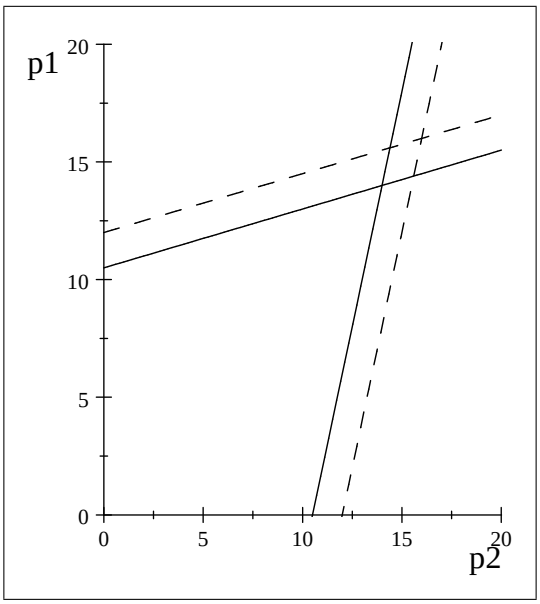


The shifting of the reaction function for firm 1 leads to higher prices for both firms. The price increase is greatest for the firm whose costs increase.

$$\begin{aligned} p_1 &= \frac{A + p_2/2 + c_1}{2} \\ p_2 &= \frac{A + p_1/2 + c_2}{2} \end{aligned}$$

Equilibrium prices are now $p_1 = 15.6, p_2 = 14.4$

c)



Now both prices increase by the same amount.

$$\begin{aligned} p_1 &= \frac{A + p_2/2 + c_1}{2} \\ p_2 &= \frac{A + p_1/2 + c_2}{2} \end{aligned}$$

Equilibrium prices are now $p_1 = 16, p_2 = 16$

d) See answers above. To examine pass-through we need to examine equilbrium prices rather than just differentiating the reaction functions.

$$\begin{aligned} p_1 &= \frac{A + p_2/2 + c_1}{2} \\ p_2 &= \frac{A + p_1/2 + c_2}{2} \end{aligned}$$

$$\begin{aligned} p_1 &= \frac{2}{3}A + \frac{8}{15}c_1 + \frac{2}{15}c_2 \\ p_2 &= \frac{2}{3}A + \frac{2}{15}c_1 + \frac{8}{15}c_2 \end{aligned}$$

So at $A = 19$, $c_1 = 5$, $c_2 = 2$ $p_1 = \frac{2}{3}19 + \frac{8}{15}5 + \frac{2}{15}2 = 15.6$

and

$$\frac{dp_1}{dc_1}\frac{c_1}{p_1} = \frac{8}{15}\frac{5}{15.6} \approx 0.17$$

And at $A = 19$, $c_1 = 2$, $c_2 = 5$ $p_1 = \frac{2}{3}19 + \frac{8}{15}2 + \frac{2}{15}5 = 14.4$

and

$$\frac{dp_1}{dc_1}\frac{c_1}{p_1} = \frac{8}{15}\frac{2}{14.4} \approx 0.07.$$