

The Cournot Model

$$p = a - bx$$

$$a = 17, c = 1, b = 1$$

so that the competitive solution is 16 units of output and the monopoly solution is 8 units of output

$$\text{profits } \pi_i = [17 - (x_i + x_{-i})]x_i - x_i$$

here $i = 1, 2$ where firm 1 is Microsoft and firm 2 is Peach

The Best Response or Reaction Function

Suppose that Microsoft (1) expects that Peach (2) will produce x_2 units of output. What should Microsoft do?

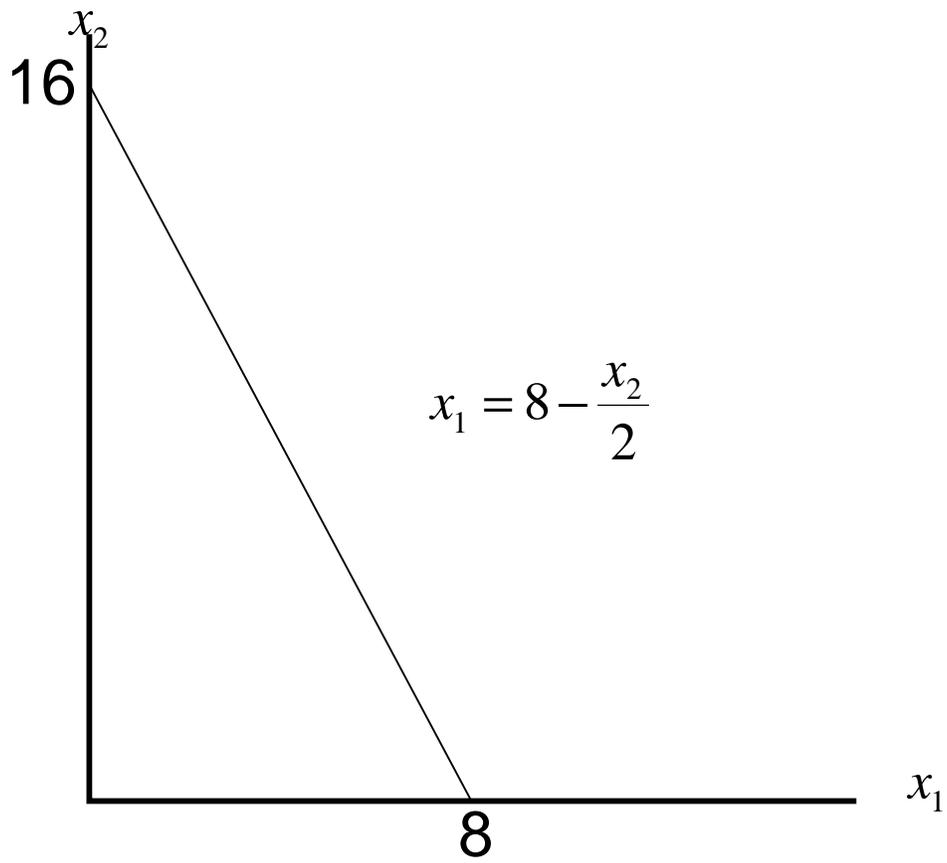
$$\pi_1 = [17 - (x_1 + x_2)]x_1 - x_1$$

$$\frac{d\pi_1}{dx_1} = 16 - 2x_1 - x_2 = 0$$

solving we find

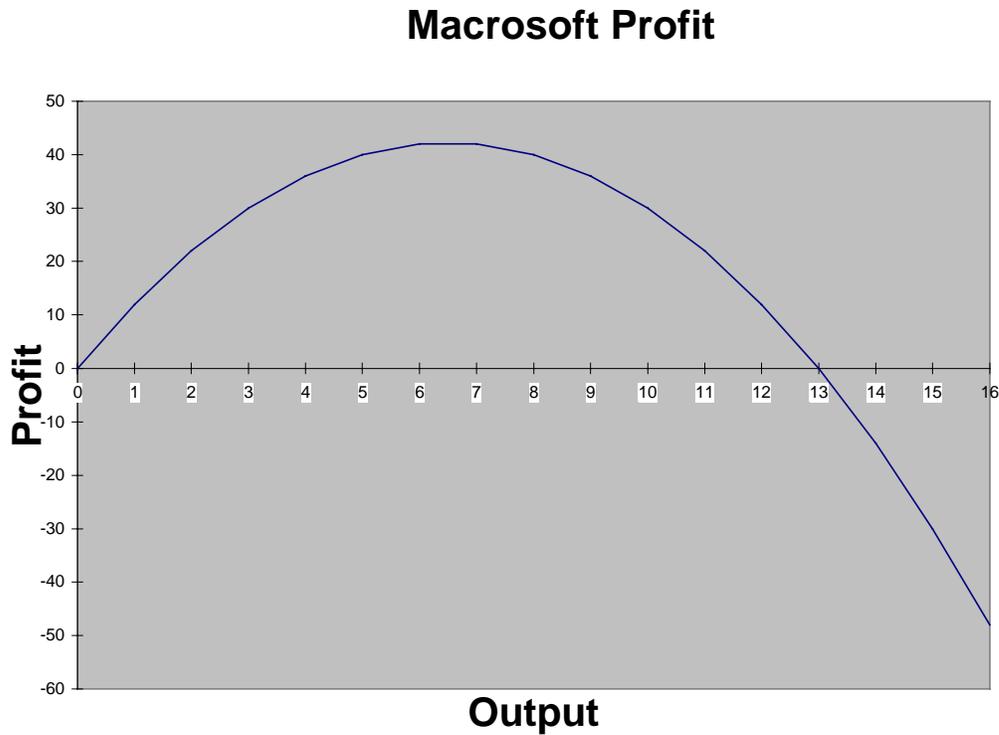
$$x_1 = 8 - \frac{x_2}{2}$$

This is called the *best response* or *reaction* function of Microsoft (1) to Peach (2).



Profits

$$\pi_i = [17 - (x_i + x_{-i})]x_i - x_i, \quad \pi_i = [16 - (x_i + x_{-i})]x_i$$



Observe that for fixed output of Peach ($-i$) the profit of Microsoft (i) is concave. We can also see this by differentiating profits twice:

$$\frac{d^2 \pi_i}{dx_i^2} = -2$$

Implications of Concavity

Profits increase to the left of the optimum, and decrease to the right of the optimum. Notice also from the best response function

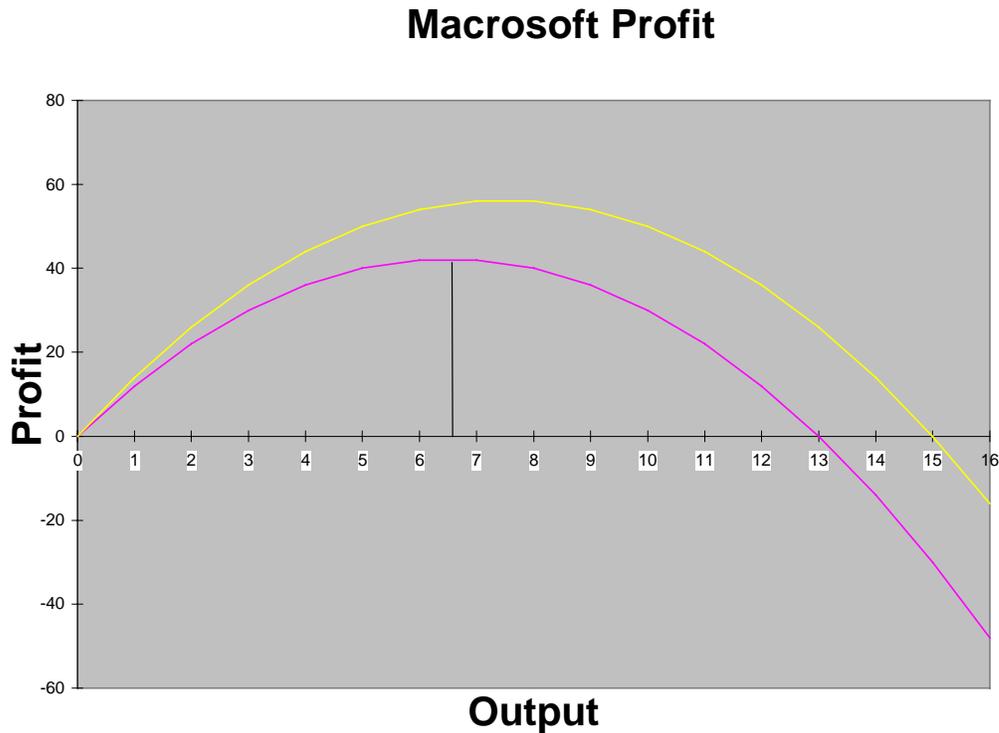
$$x_i = 8 - \frac{x_{-i}}{2}$$

that the optimum declines with output of the rival firm Peach ($-i$); Let x be some output level for Peach ($-i$).

- If Peach ($-i$) produces less than or equal to x then the best response to x strictly dominates any smaller output level
- If Peach ($-i$) produces greater than or equal to x then the best response to x strictly dominates any larger output level

In particular since Peach ($-i$) never produces less than zero, the monopoly output of 8 by Macrosoft (i) strictly dominates any larger output level

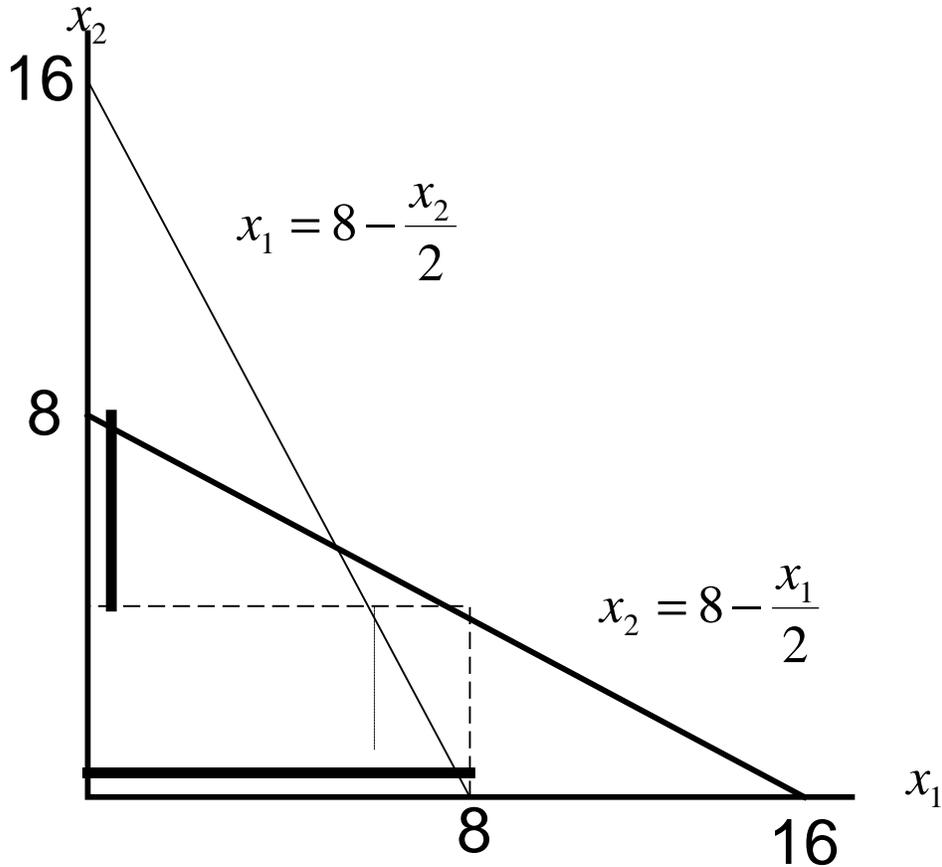
If Peach ($-i$) produces less than or equal to x then the best response to x strictly dominates any smaller output level



purple line corresponds to output level x by Peach; best response is 6.5

yellow line corresponds to a smaller output level by Peach (and so higher profits for Microsoft)
notice how the yellow curve declines to the left of 6.5

Iterated Strict Dominance



Continuing in this way, we see that the only point that remains after iterated strict dominance is the point where the two reaction functions cross

The Cournot Equilibrium

$$x = \frac{16 - x}{2}$$

$$x = \frac{16}{3}$$

less than monopoly but more than half monopoly

industry output is twice this amount
this is $\frac{2}{3}$ the competitive output, as against $\frac{1}{2}$
for monopoly

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