Stackelberg Equilibrium

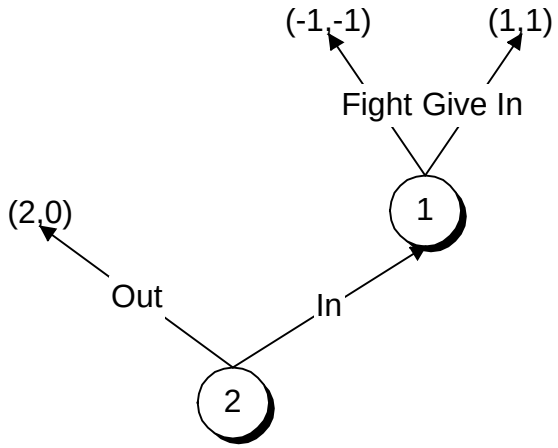
- precommitment

to be effective a precommitment must be

- public
- credible

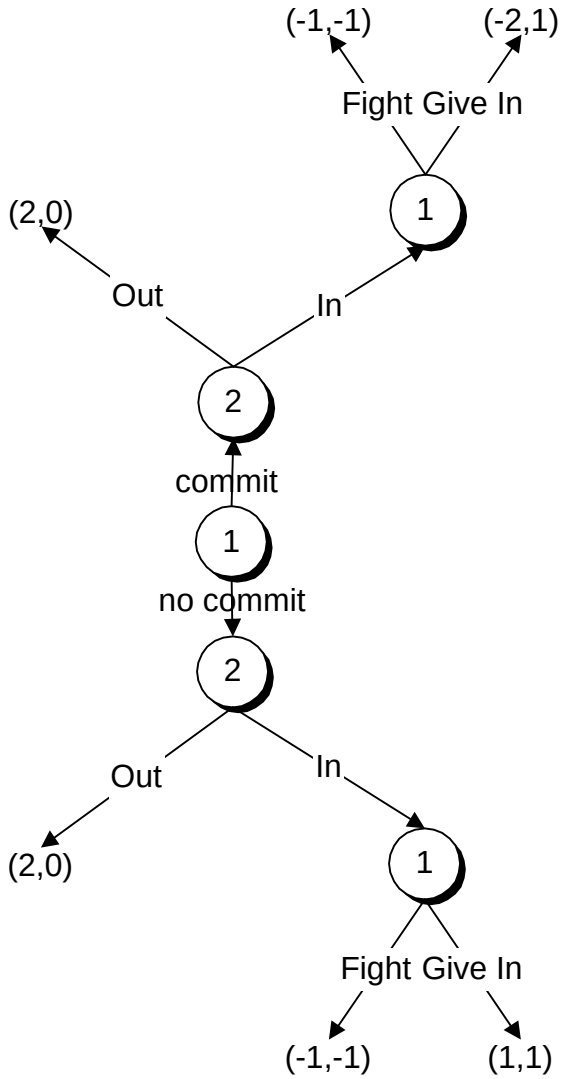
- Dr. Strangelove

The Chain Store Game



player 1 is the *Stackelberg leader*

gives rise to a new extensive form



Stackelberg Leadership in Duopoly

$$p = a - bx$$

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

so that the competitive solution is 16 units of output, the monopoly solution is 8 units of output, the Cournot solution 10 2/3

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

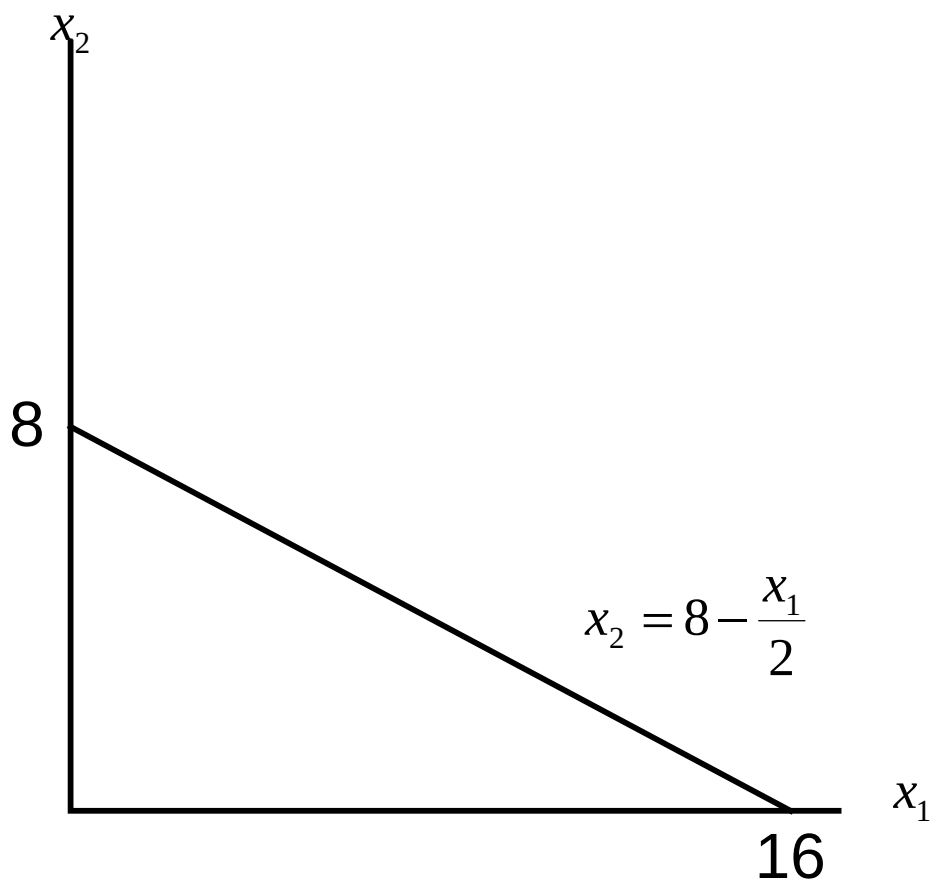
firm 1 is the Stackelberg leader

solve the game by *backwards induction*

- firm 1 precommits to producing x_1 units of output
- what does firm 2 do?
- subgame perfection says that firm 2 must play a best response, or equivalently, must be on its reaction function.

recall that the best-response function for firm 2 is

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


x_2
8
$x_2 = 8 - \frac{x_1}{2}$
x_1
16

Formal Solution of the Stackelberg Problem

maximize

$$\pi_1 = [16 - (x_1 + x_2)]x_1$$

subject to

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

may solve by Lagrange multipliers, or by direct substitution

$$\pi_1 = \left[16 - (x_1 + 8 - \frac{x_1}{2})\right] x_1$$

$$= \left[8 - \frac{x_1}{2}\right] x_1$$

$$\frac{d\pi_1}{dx_1} = \left[8 - \frac{x_1}{2}\right] - \frac{x_1}{2} = 0$$

so that at the optimum $x_1 = 8$ which is the same as the monopoly solution

Summary of the Stackelberg Equilibrium

	Stackelberg	Cournot	Monopoly	Competitition
x_1	8	5 1/3	8	8
x_2	4	5 1/3	0	8
x	12	10 2/3	8	16
p	5	6 1/3	9	1
π_1	32	28.4	64	0
π_2	16	28.4	0	0
π	48	56.9	64	0