By definition, $BR(q_1)$ tells us the profit-maximizing output of firm 2 taking $q_1$ as given.

Strategic substitutes: $q_1 \uparrow \Rightarrow BR_2(q_1) \downarrow$

$q_1 \uparrow$ this suggests firm 1 should set $q_1 > q_1^c$
$q_2 \downarrow$

Firm 1's profits $\uparrow$

$(q_1, q_2) \uparrow \Rightarrow p \downarrow$ so firm 2 profit $\downarrow$

$CS \uparrow$

<p>

$P = a - b(q_1 + q_2)$

Profit$_i = P q_i - c q_i$

$BI$ solve for firm 2 first, taking $q_1$ as given

$max_{q_2} \left[ a - b q_1 - b q_2 \right] q_2 - c q_2$

$d(discriminate \ with\ respect\ to\ q_2,\ set\ to\ 0)$

Solved $q_2 = \frac{a - c - q_1}{2b}$

Now solve for firm 1

$max_{q_1} \left[ a - b q_1 - b \left( \frac{a - c - q_1}{2b} \right) \right] q_1 - c q_1$

$max_{q_1} \left[ a - b q_1 - \left( \frac{a - c - q_1}{2} \right) \right] q_1$

diff w.r.t. $q_1$

$\Rightarrow \frac{a - c}{2} - b q_1 \Rightarrow$ First order condition

$\Rightarrow a - c - b q_1 \Rightarrow 0$

$<<$ second order condition ok: $\frac{d^2}{dq_1^2} = -b < 0$
\[
q_1 = \frac{(a - c)}{2b}
\]

\[
q_2 = \frac{a - c}{2b} - \frac{1}{2} \left(\frac{a - c}{2b}\right)
\]

\[
q_2 = \frac{a - c}{4b}
\]

Check:

- \(q_1\) new > \(q_1\) old (\(\neq q^c\))

- \(q_2\) new < \(q_2\) old (\(\neq q^c\))

\[
\frac{q_1 + q_2}{\text{new}} = \frac{3(a - c)}{4b} > \frac{2(a - c)}{3b} = \frac{q^c + q^d}{\text{old}}
\]

Commitment

- Sunk costs can help

3. **Spy** or having more information can hurt you

   - Key: the other players knew you had more information \(\gg\) for it to hurt you \(\ll\) that information

   - Reason: it can lead other players to take actions that hurt you

<< more info can hurt - spy 
more options can hurt - Saxon army, collateral >>

3. **FIRST-MOVER ADVANTAGE**

   - Yes sometimes: Stuckelberg
   - But not always: Rock, Paper, Scissors
   - Learning from Mistakes

   - Second-mover advantage: Information here is helpful

   - Sometimes neither first nor second mover adv: "I split, you choose."

piles equal \(\Rightarrow\) second mover advantage
piles unequal \(\Rightarrow\) first mover advantage

1. You know who'll win from the initial setup
2. Solve by backwards induction
3. Can be first or second mover advantage depending on setup

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