Rivalry

Or, competition is tough.

Shrimp Game Analysis

Recall the setup

- Demand: $P(q_a, q_b, q_c) = 45 - 0.2(q_a + q_b + q_c)$
- Profit: $\Pi_i(q_a, q_b, q_c) = (P - 5)q_a$

Cooperation

Under complete cooperation, the three shrimpers behave to maximize joint profits, which is the same thing as what a monopolist would do.

- Let $Q = q_a + q_b + q_c$
- Joint profits are $(40 - 0.2Q)Q$
- The first-order condition is $40 - 0.4Q^* = 0 \Rightarrow Q^* = 100$ (so $q_i^* = 33$)
- Total profits are 2000, and individual profits are 667

Optimal Defection

Suppose you expect your rivals to cooperate and produce 33 per above.

- Your profits are $(40 - 0.2(67 + q_i))q_i$
- The first-order condition is $27 - 0.4q_i^* = 0 \Rightarrow q_i^* = 67$
- Total profits are 1778. Your profits are 889, and your rivals' profits are 444

Suppose two people reason this way

- So e.g. $q_a^* = 33, q_b^* = 67, q_c^* = 67$
- Total profits are 1111. Individual profits are 444, 444, and 222 respectively

Suppose three people reason this way

- So e.g. $q_i^* = 67$
- All profits are 0
- https://youtu.be/rY-FJvRqK0E

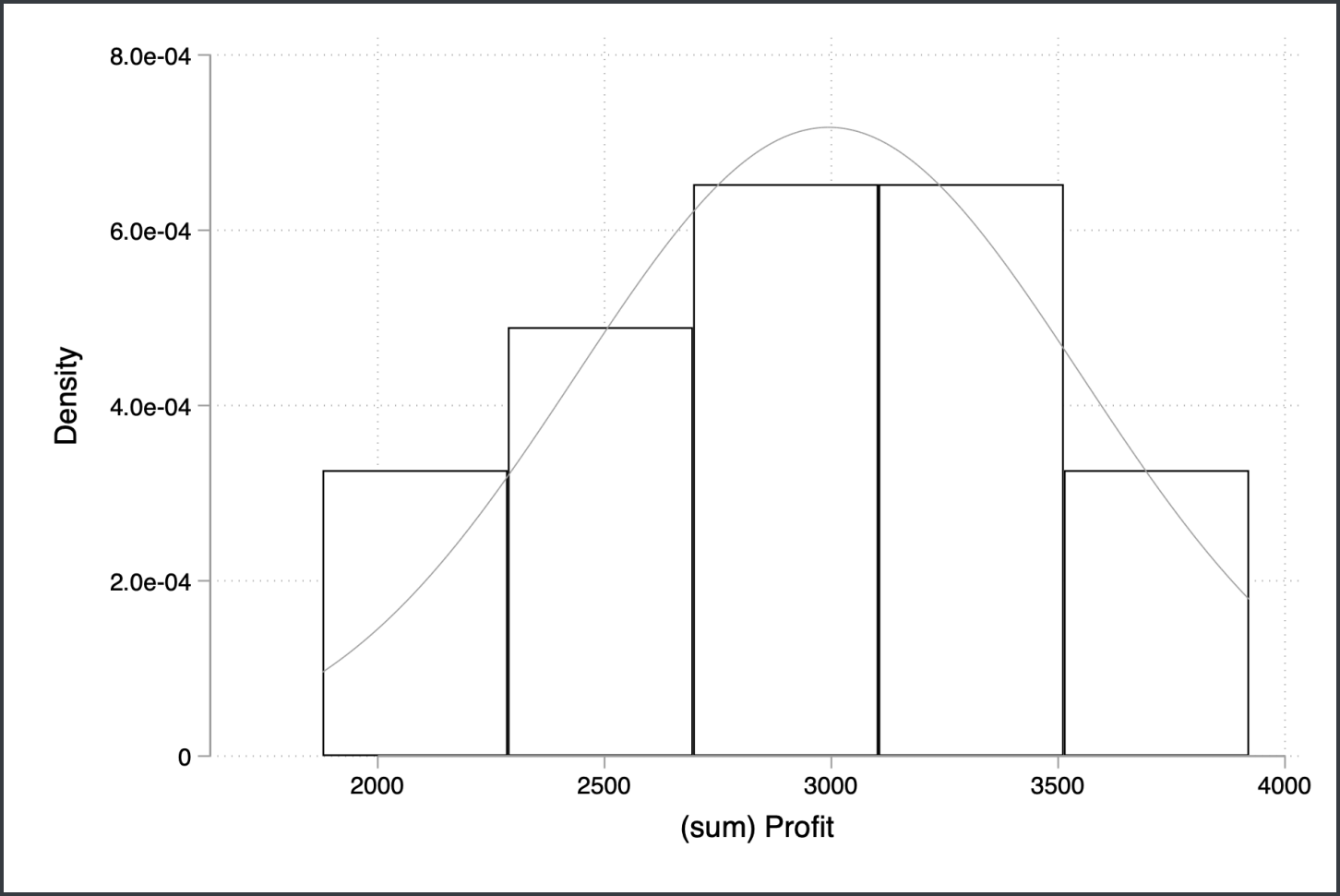
Nash Equilibrium

The Nash Equilibrium is the set of quantities such that each shrimper produces optimally given the *correct* expected actions of rivals.

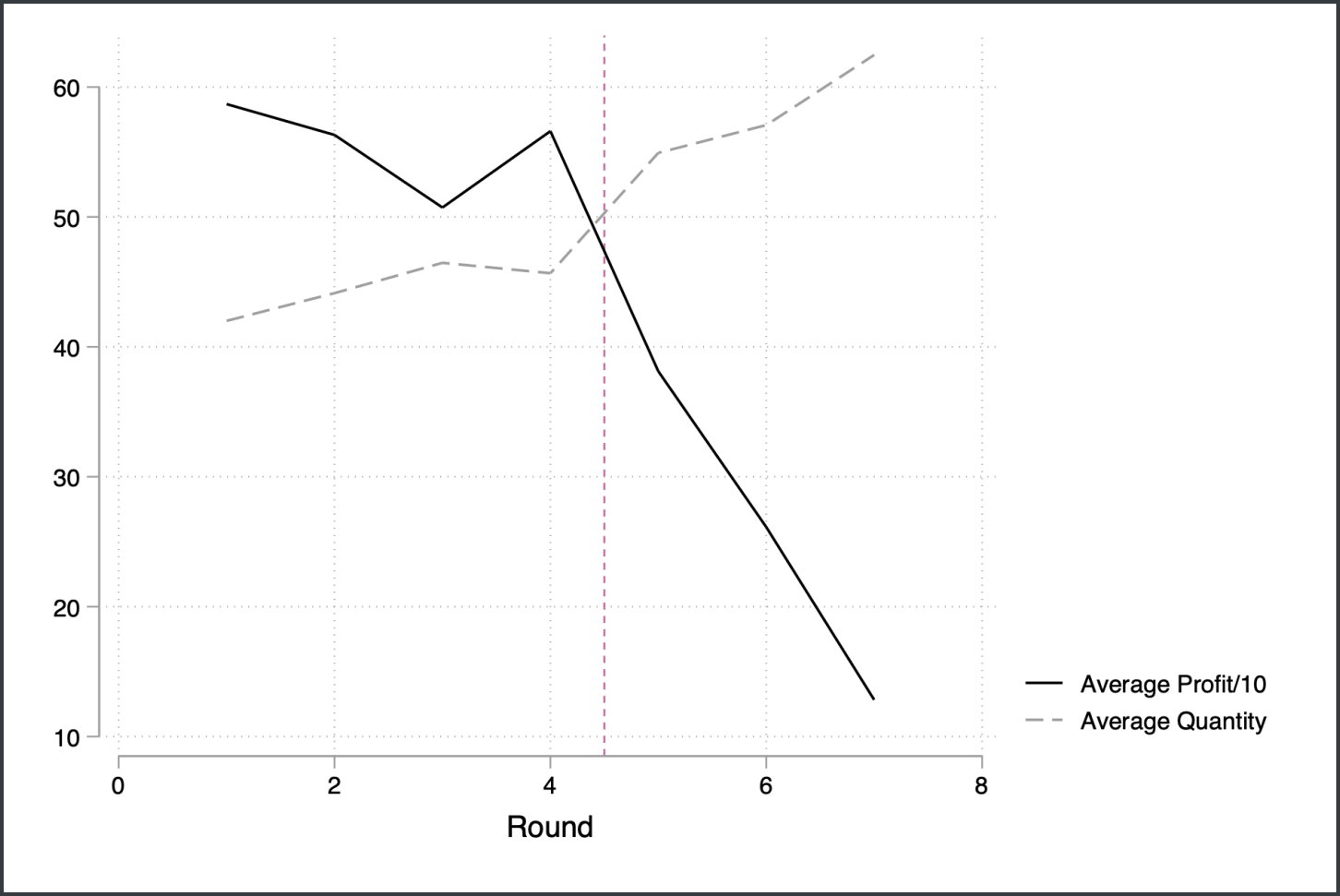
- For a given belief of Beatrice and Charlotte's quantities, Arnold's profits are $(40 - 0.2(q_a + q_b + q_c))q_a$
- The first-order condition is $40 - 0.4q_a^* - 0.2(q_b + q_c) = 0 \Rightarrow q_a^* = 100 - .5(q_b, +q_c)$
- By symmetry, everyone will reason this way, so we know $q_a^* = q_b^* = q_c^* \Rightarrow q_a^* = 100 - .5(q_a^*, +q_c^*) \Rightarrow q_i^* = 50$
- Total profits are 1500, and individual profits are 500

Shrimp Results

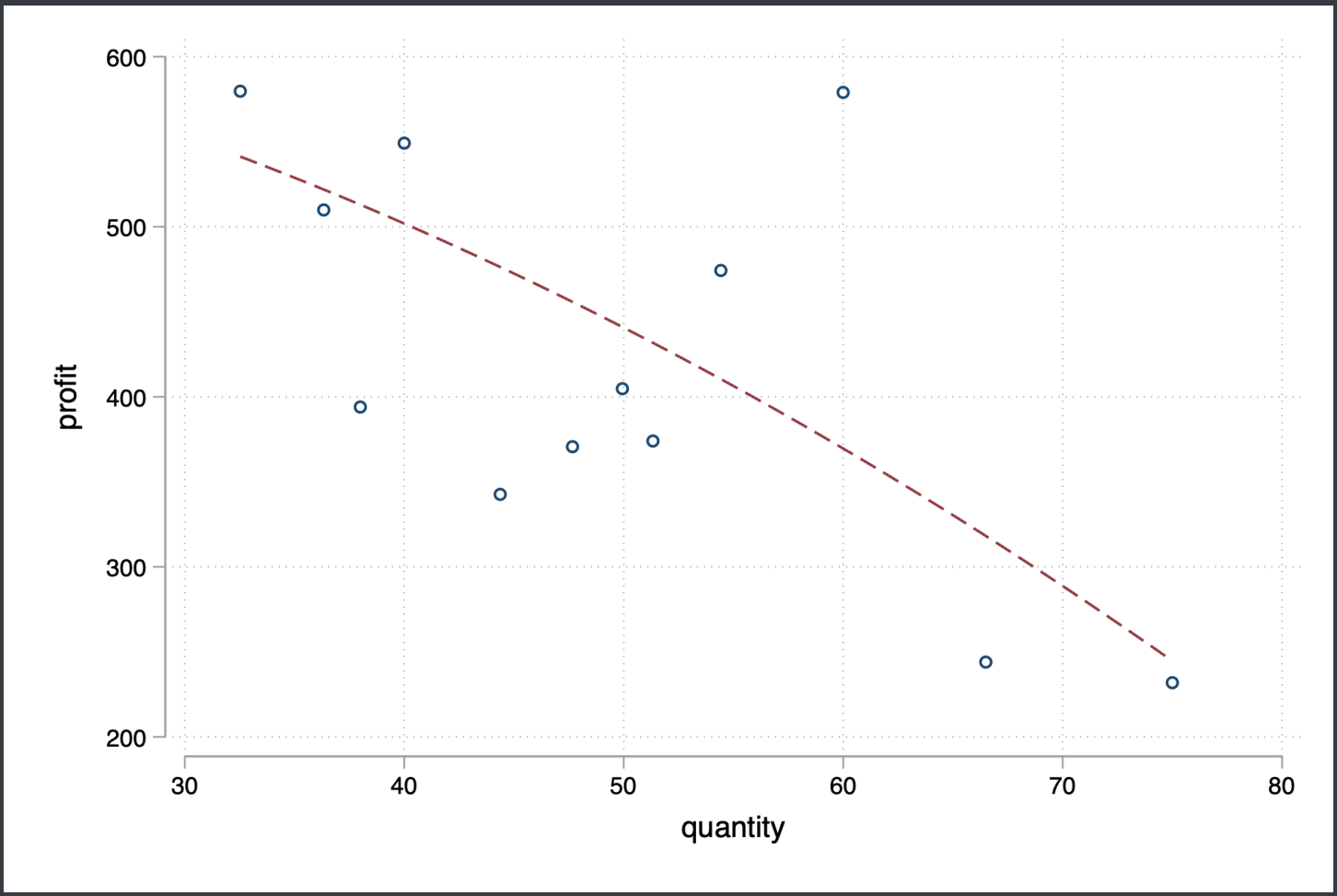
Total profits varied by quite a bit (Mazel to the winning teams!)



Started off cooperating, but the incentives to defect were strong... Note the dashed line is when I allowed y'all to announce a message beforehand!



The most profitable teams were the ones that could sustain cooperation.



Don't be a jerk!

Takeaways

1. Competition in concentrated markets (oligopoly) is very different from perfect competition
    1. Need to predict what your rival will do
    2. Use game theory!
2. Rivalry game
    1. Like the Prisoner's Dilemma
    2. The problem is competition, the solution is repetition

Next Week, A Different Solution

Pick the game you're playing! https://youtu.be/rMz7JBRbmNo