

Lecture XVI: Cournot, Bertrand, and the Prisoner's Dilemma

Charles B. Moss

July 24, 2014

Readings

The Cournot Equilibrium

Bertrand Equilibrium

Game Theory and the Prisoner's Dilemma

Readings

- A. Becker Chapter 8 (Lectures 28 - 31)
- B. Friedman & Friedman Chapter 5

The Cournot Equilibrium

- ▶ The Cournot equilibrium shares some of the concepts from the Stackelberg discussed in Lecture 15.
- ▶ Kreps, D.M. 1990. *A Course in Microeconomic Theory*. Princeton University Press (pp. 325–335)
- ▶ The Cournot equilibrium assumes that each firm has *Cournot conjectures* about it's rivals – each firm assumes that the other firm will react in a way to keep fixed the quantity it sells. In Lecture 15, we had a conjecture about the response of Firm 2

$$q_2(q_1) = \frac{q_1 - \alpha_0 - \gamma_0\alpha_1}{\gamma_1 - 1} \quad (1)$$

- ▶ Based on this conjecture, we can derive a reaction function to the other firm's choice.
- ▶ In Kreps, Firm 1 conjectures that the price is $A - q_2 - q_1$ (i.e., the inverse demand function).
- ▶ The profits for Firm 1 as a function of q_1 will be

$$\pi(q_1, q_2) = (A - q_2 - q_1)q_1 - kq_1. \quad (2)$$

- ▶ This is maximized at

$$q_1^*(q_2) = \frac{A - k - q_2}{2}. \quad (3)$$

- This is the reaction function of Firm 1 to Firm 2 – given any action of Firm 2 (q_2) this is how Firm 1 acts to maximize profit. Similarly, there is the choice by Firm 2 which is

$$q_2^*(q_1) = \frac{A - k - q_1}{2}. \quad (4)$$

- In the Cournot equilibrium, we assume that neither player is the leader (or better neither player is the follower). The equilibrium is determined by

$$\left. \begin{aligned} \hat{q}_1 &= q_1^*(\hat{q}_2) \\ \hat{q}_2 &= q_2^*(\hat{q}_1) \end{aligned} \right\} \hat{q}_1 = \hat{q}_2 = \frac{A - k}{3}. \quad (5)$$

Cournot Equilibrium

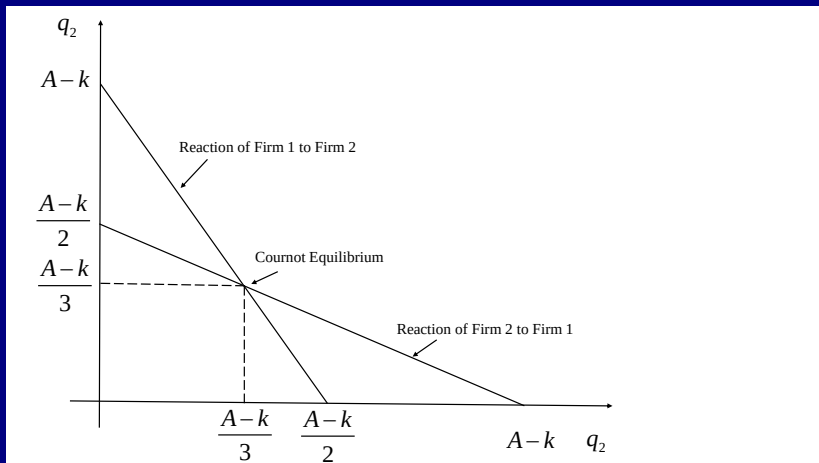


Figure : Cournot Equilibrium

- Notice how similar this is to the Stackelberg graph depicted in Figure 2.

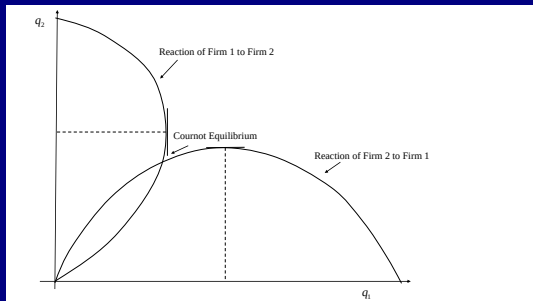


Figure : Cournot Equilibrium

- ▶ The price of the Cournot equilibrium is higher than the competitive price, but lower than the monopoly.

Bertrand Equilibrium

- ▶ The Bertrand equilibrium is similar to the Cournot, except that we assume that the duopolist compete by setting prices.
- ▶ In this case, we have three different price equilibria
 - ▶ If $\hat{p}_1 < \hat{p}_2$ then $\hat{q}_1 = A - \hat{p}_1$ and $\hat{q}_2 = 0$.
 - ▶ If $\hat{p}_2 < \hat{p}_1$ then $\hat{q}_2 = A - \hat{p}_2$ and $\hat{q}_1 = 0$.
 - ▶ If $\hat{p}_1 = \hat{p}_2$ then $\hat{q}_1 + \hat{q}_2 = A - \hat{p}_1$.

Game Theory and the Prisoner's Dilemma

- ▶ The basic concept of the prisoner's dilemma is that two thieves collaborate, but get caught. In classic crime show style each thief is offered a deal – if you turn state's evidence (rat on your compatriot) you will get a better deal (i.e., no prison).
- ▶ What we are dealing with is a payoff matrix

Table : Payoff Matrix

Player 2	Player 1	
	t1	t2
s1	5,5	-3,8
s2	8,-3	0,0