Microeconomic Theory — ECON 323 503
Chapter 14: Oligopoly ~~and Monopolistic Competitions~~

Vikram Manjunath

Texas A&M University

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Outline

1. The Cournot oligopoly model: two (or more) firms simultaneously pick quantities to produces.

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2. The Stackelberg oligopoly model: two firms pick quantities one after another.
3. The Bertrand oligopoly model: two (or more) firms simultaneously pick prices.

The Cournot oligopoly model

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1. Any quantity is possible (not just 48, 64, or 96).
2. There are n airlines, not just 2.

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Assume constant MC of \$147 and no fixed cost so that $AC = MC$.

Monopoly for comparison

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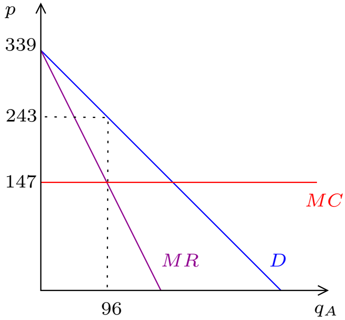

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If A picks q_A, what is its revenue?

$$\begin{aligned} R_A(q_A) &= pq_A \\ &= ((339 - q_U) - q_A)q_A \\ &= 339q_A - q_U q_A - q_A^2. \end{aligned}$$

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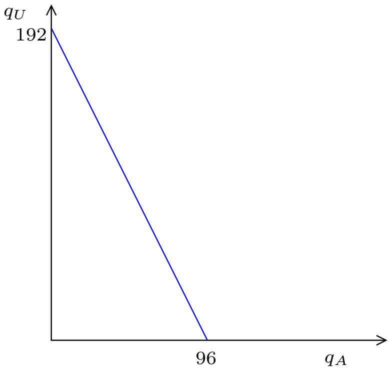
A's best response



If U doesn't produce anything, A picks 96. If U produces 192 or more, A's best response is to shut down.

U's best response

The two firms are identical.

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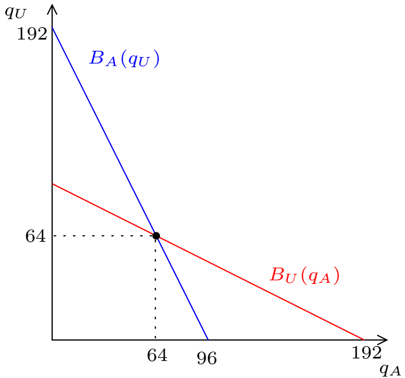
$$q_A = 96 - \frac{1}{2}q_U \text{ and } q_B = 96 - \frac{1}{2}q_A.$$

Solving for q_A and q_U,

$$q_A = q_U = 64.$$

Graphically



With many firms

If there are n firms producing $q_1, q_2, \ldots, q_n$:

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Cost for firm i is $C(q_i)$.

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Start with firm 1's decision. Its profit is (when production decisions are $q_1, \ldots, q_n$)

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Firm 1's first order condition:

$$\frac{\delta \pi}{\delta q_1} = p(Q) + q_1 \frac{dp(Q)}{dQ} \frac{\delta Q}{\delta q_1} - \frac{dC(q_1)}{dq_1} = 0$$

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Firm 1's *best response* to the other firms' choices is to pick q_1 that solves this equation.

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Since there are n firms, $Q = nq$.

How far from competitive?

Let's mess MR a little so that we can figure out the ratio $\frac{p}{MC}$.

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$$p = \frac{MC}{\left[1 + \frac{1}{n\varepsilon}\right]}.$$

Or

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How far are we from the competitive market outcome?

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So as the number of firms in the Bertrand game, the closer we get to the competitive outcome.

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If $q_2 = q_3 = \cdots = q_n = q$, then

$$q_1 = B_1(q_2, \dots, q_n) = \frac{a - m}{2b} - \frac{n-1}{2} q.$$

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As n grows larger, these get closer to the competitive quantity and price.

The airline game

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Using what we solved earlier

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Using what we solved earlier

$$q = \frac{339 - 147}{n+1} \text{ and } p = \frac{339 + 147n}{n+1}.$$

Check that if $n = 1$ we get the monopoly price/quantity and if $n = 2$ we get the duopoly price/quantity.

The Stackelberg oligopoly model

A picks a quantity first and then U gets to pick.

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A picks a quantity first and then U gets to pick.

If A has chosen q_A, we already figured out what U will do:

$$q_U = B_U(q_A) = 96 - \frac{1}{2}q_A$$

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&= p(q_A + (96 - \tfrac{1}{2}q_A))q_A - mq_A \\
&= (339 - 96 - \tfrac{1}{2}q_A)q_A - 147q_A
\end{aligned}$$

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&= (339 - 96 - \tfrac{1}{2}q_A)q_A - 147q_A \\
&= 96q_A - \tfrac{1}{2}q_A^2.
\end{aligned}$$

A's choice

$$\frac{d\pi_A}{dq_A} = 0$$

A's choice

$$\begin{aligned} \frac{d\pi_A}{dq_A} &= 0 \\ \frac{d\left(96q_A - \frac{1}{2}q_A^2\right)}{dq_A} &= 0 \end{aligned}$$

A's choice

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96 - q_A &= 0 \\
q_A &= 96.
\end{aligned}
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So,

$$q_U = B_U(q_A) = 96 - \frac{1}{2}q_A = 96 - \frac{1}{2}96 = 48.$$

The Bertrand oligopoly model

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If firm 1's price is higher than firm 2's price: all consumers buy only from firm 2.

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If firm 1's price is higher than firm 2's price: all consumers buy only from firm 2.

Assume that MC is constant ($MC = \$5$)

Nash-Bertrand Equilibrium

What happens if firm 1 charges \$10?

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If firm 1 charges \$5.01, firm 2 would charge \$5.005

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Unless a firm charges \$5 $= MC$, the other would under cut it.

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Unless a firm charges $\$5 = MC$, the other would under cut it.

Caveat: this reasoning relies on firms beign able to produce any quantity.

Do we only need two firms for profits to disappear?

Which is more realistic: Bertrand or Cournot?

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1. Observed oligopoly prices are typically, like the Cournot price, between the competitive price and the monopoly price.
2. The Bertrand price only depends on cost and is completely independent of demand. But observations are that prices vary with demand.