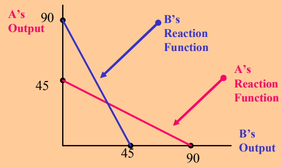
The Cournot Model



Assumptions

- Two firms A, and B produce widgets

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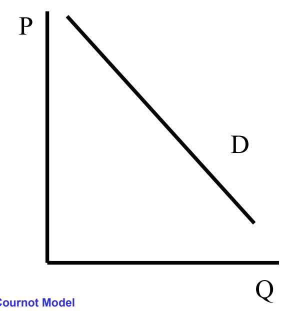
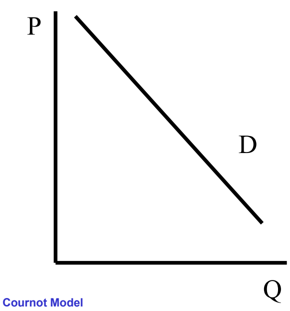
- The industry demand function is D



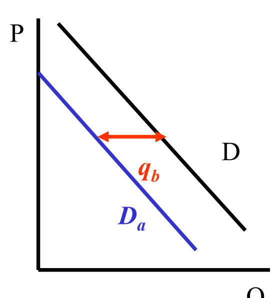
Assumptions

- Two firms A, and B produce widgets
- The industry demand function is D
- Firm A produces q_A; firm B produces q_B



Assumptions

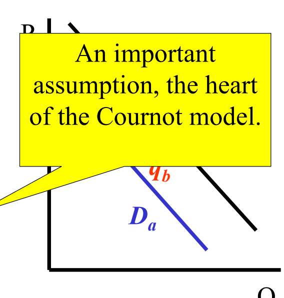
- Two firms A, and B produce widgets
- The industry demand function is D
- Firm A produces q_A; firm B produces q_B
- Firm A takes its demand function as D - q_B



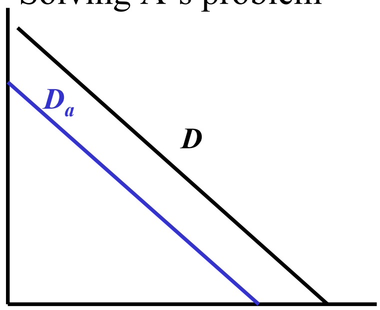
Assumptions

- Two firms A, and B produce widgets
- The industry demand function is D
- Firm A produces q_A; firm B produces q_B
- **Firm A takes its demand function as D $-q_B$**

An important assumption, the heart of the Cournot model.



Solving A's problem



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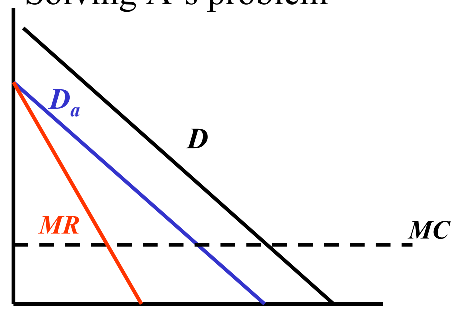

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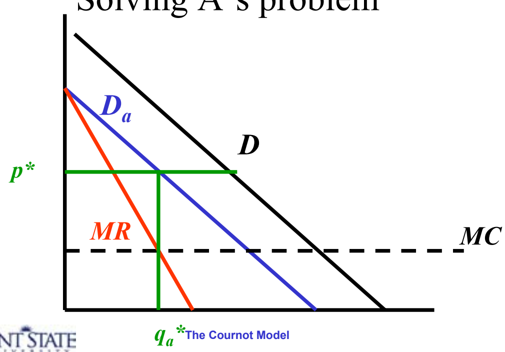

Symmetry

- Just as Firm A is choosing q_A to maximize profits, so too is Firm B choosing q_B to maximize profits.

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- Just as Firm A is choosing q_A to maximize profits, so too is Firm B choosing q_B to maximize profits.
- If B changes its output, A will react by changing its output.

A Reaction Function

- We do the mathematical approach first and then the graphical approach.

A Reaction Function

- The industry demand function

$$Q = 100 - 2p.$$

A Reaction Function

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$$P = 50 - (1/2)Q$$

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$$Q = 100 - 2p.$$

- The inverse demand function is

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- A's demand function is then

$$P = 50 - (1/2)(q_A + q_B)$$

A Reaction Function

A's demand function is then

$$P = 50 - (1/2)(q_A + q_B)$$

- The firm's profits are

$$\pi = Pq_A - 5q_A$$

A Reaction Function

A's demand function is then

$$P = 50 - (1/2)(q_A + q_B)$$

- The firm's profits are

$$\pi = [50 - (1/2)(q_A + q_B)]q_A - 5q_A$$

A Reaction Function

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A Reaction Function

$\pi = [50 - (1/2)(q_A + q_B)]q_A - 5q_A$

$\pi = 50\, q_A - (1/2)\, q_A{}^2 - (1/2)q_B q_A - 5q_A$

A Reaction Function

$\pi = [50 - (1/2)(q_A + q_B)]q_A - 5q_A$

$\pi = 50\, q_A - (1/2)\, q_A{}^2 - (1/2)q_B q_A - 5q_A$

$\pi = 45q_A - (1/2)q_A{}^2 - (1/2)q_B q_A$

A Reaction Function

$$\pi = 45q_a - \frac{1}{2}q_a^2 - \frac{1}{2}q_a q_b$$

A Reaction Function

$$\pi = 45q_a - \frac{1}{2}q_a^2 - \frac{1}{2}q_a q_b$$

$$\frac{d\pi}{dq_a} = 45 - q_a - \frac{1}{2}q_b$$

A Reaction Function

$$\frac{d\pi}{dq_a} = 45 - q_a - \frac{1}{2}q_b = 0$$

$$\boxed{q_a = 45 - \frac{1}{2}q_b}$$

Symmetry

$q_A = 45 - (1/2)q_B$

- **There is a similar reaction function for B**

  $q_B = 45 - (1/2)q_A$

Solving for A's Output

$q_A = 45 - (1/2)q_B$

$q_B = 45 - (1/2)q_A$

$q_A = 45 - (1/2)[45 - (1/2)q_A]$

Solving for A's Output

$$q_A = 45 - (1/2)[45 - (1/2)q_A]$$
$$q_A = 22.5 + (1/4)q_A$$

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$$q_A = 45 - (1/2)[45 - (1/2)q_A]$$
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Solving for A's Output

$$q_A = 45 - (1/2)[45 - (1/2)q_A]$$
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$$q_A = (4/3)22.5$$

Solving for A's Output

$$q_A = 45 - (1/2)[45 - (1/2)q_A]$$
$$q_A = 22.5 + (1/4)q_A$$
$$(3/4)q_A = 22.5$$
$$q_A = (4/3)22.5$$
$$q_A = 30$$
$$q_B = 30$$

A Graphical Approach

$$q_A = 45 - (1/2)q_B$$

- We want to use the reaction function to come to a graphical solution,

A Graphical Approach

$$q_A = 45 - (1/2)q_B$$

- When B produces nothing A should react by producing the monopoly output (45).

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- When B produces the output of the competitive industry (90), A should react by producing nothing.

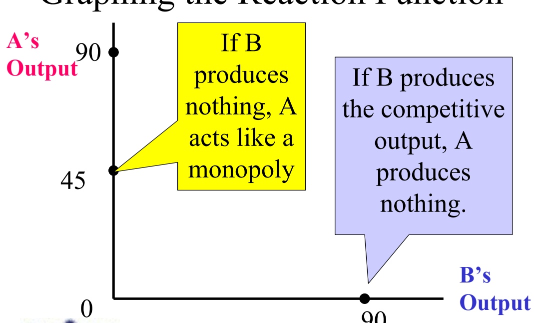
A Graphical Approach

$q_A = 45 - (1/2)q_B$

- When B produces nothing A should react by producing the monopoly output (45).
- When B produces the output of the competitive industry (90), A should react by producing nothing.
- Similar rules apply for B's reactions.

Graphing the Reaction Function

Graphing the Reaction Function



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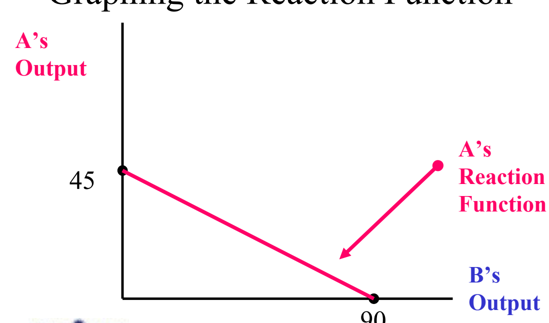

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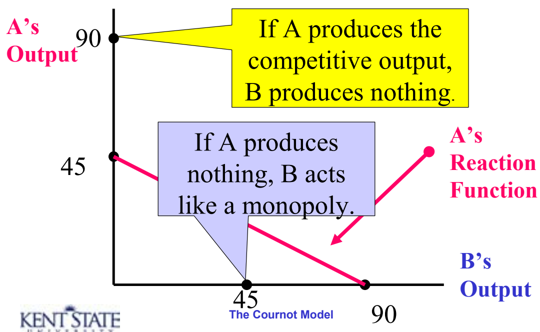

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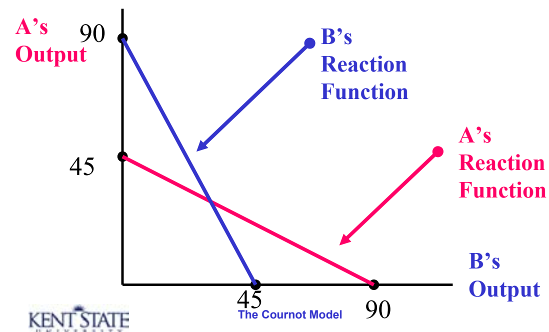

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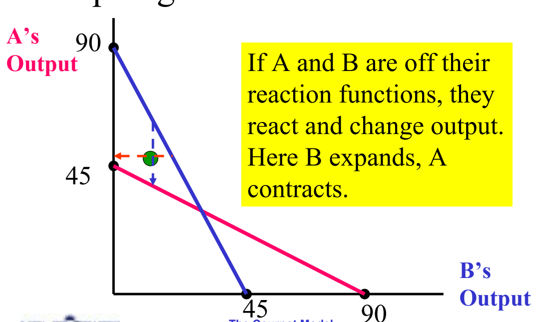

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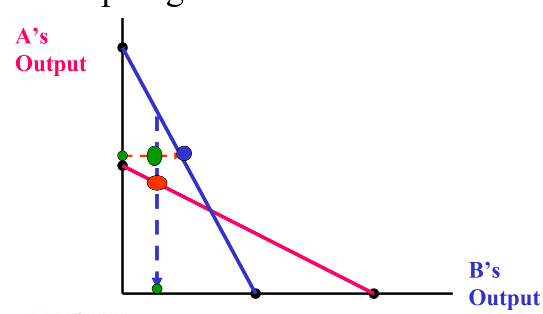

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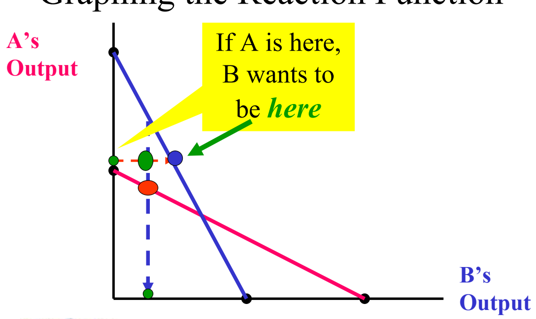

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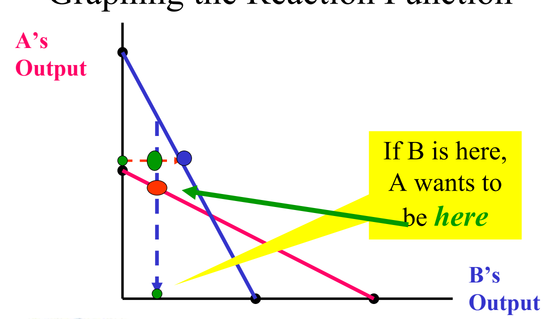
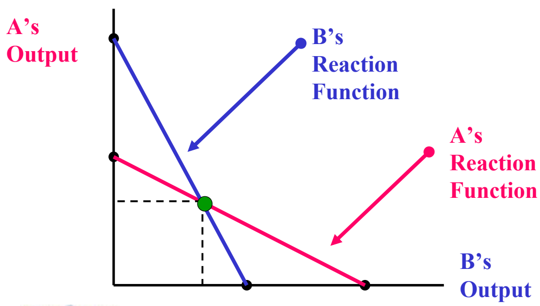


Equilibrium



The Basic Steps

- Plot the reaction functions
  - If B produces nothing, A behaves like a monopoly
  - If B produces competitive output, A produces nothing
- Solve for their intersection

End