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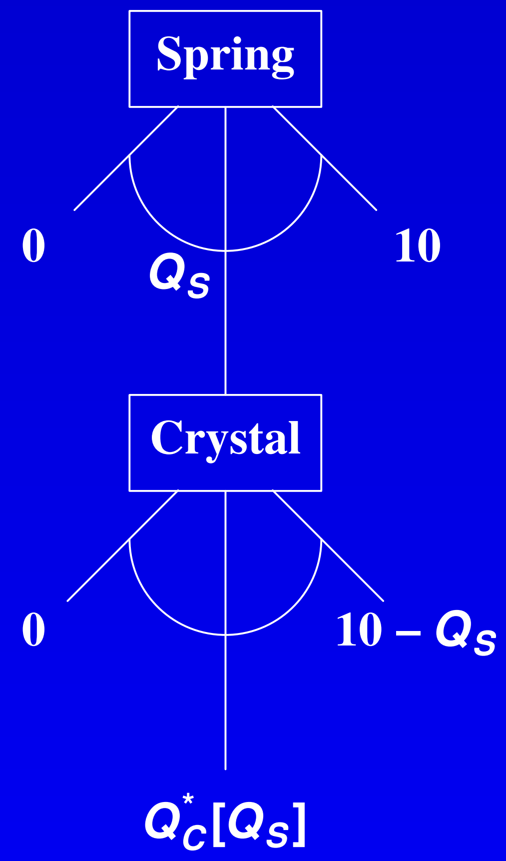

Cournot Rivalry Game Tree

(Quant. ⇨ Cournot,
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- **This function is known as the *reaction function*, since it tells us how the Follower will react to the Leader's choice (of output in this case, but it could be price).**

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- leadership — first mover
- leadership — innovator, monopolist, faced with threat of entry
- incumbent erects barriers to entry by new-comer
- long-term contracts reduce incumbent's flexibility and increase the credibility of defence

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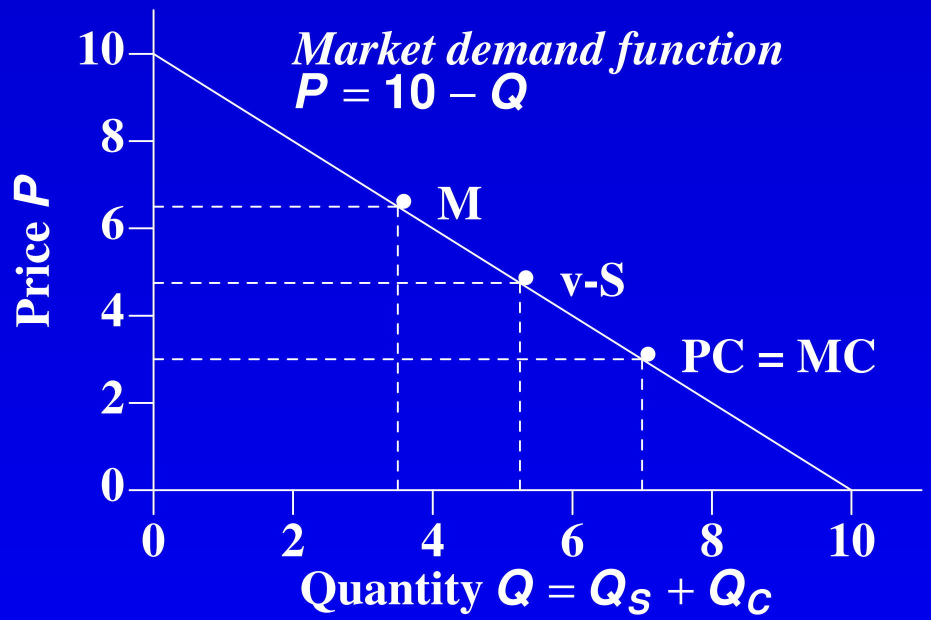
  This means that the Leader could become the Monopolist by paying the Follower not to enter the market, and offering him his (Follower's) profit of \$3.06 ($= \pi_C$) not to, and still be ahead by: \$12.25 − 3.06 − 6.125 = \$3.06.

  I.e., $\pi_M - \pi_C - \pi_S$ = \$3.06


Market demand function
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Price P
10
8
6
4
2
0
M
v-S
PC = MC
0
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6
8
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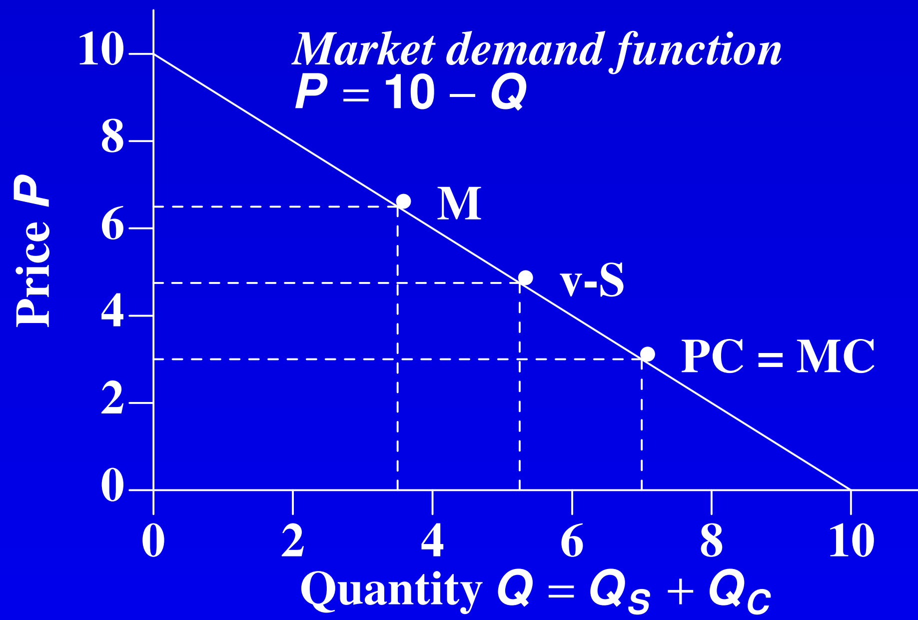
Quantity Q = Qs + Qc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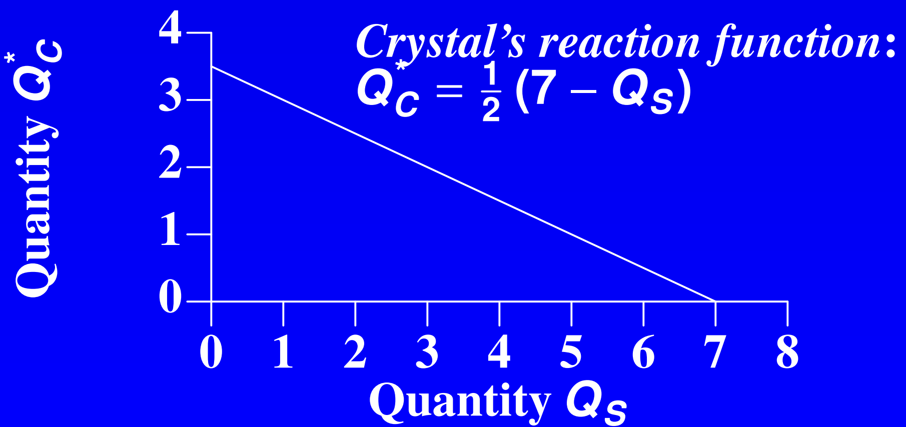
Crystal's reaction function:
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Quantity Q_S
4
3
2
1
0
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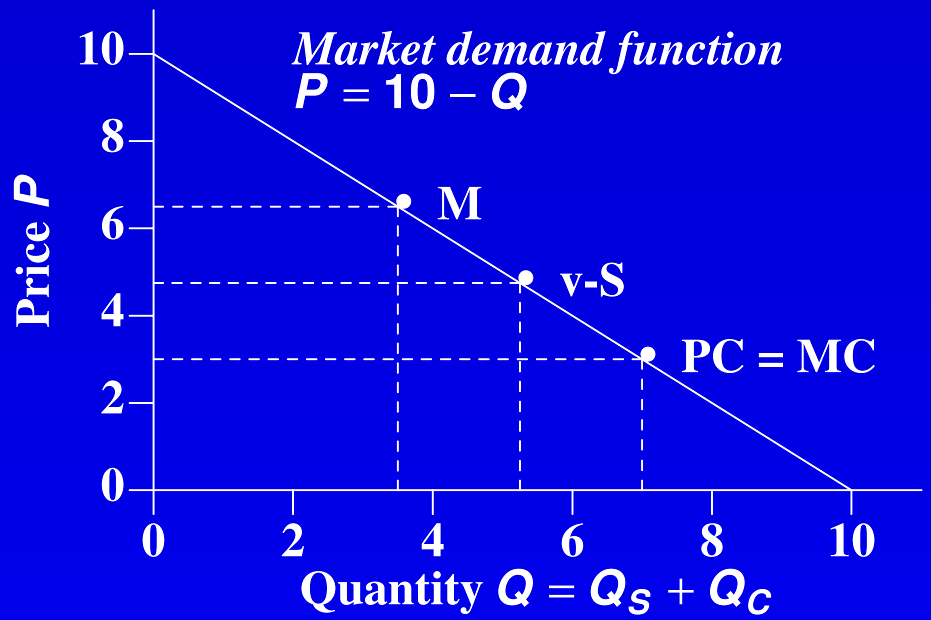

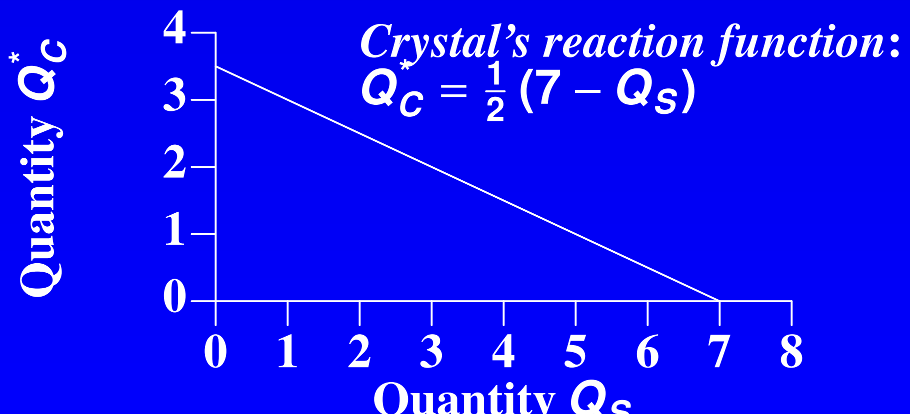

i.e. as Q_S rises, Q_C^* falls, & vice versa: *strategic substitutes.*

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How much will each firm produce if they move simultaneously?

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2. Simultaneous Cournot Quantity.

How much will each firm produce if they move simultaneously?

Each needs to:

1. **make a *conjecture or belief about how much the other firm will produce* — will it be high, with a lower industry price? Or vice versa?**
2. **then determine *its own quantity to produce* — balancing the gain from selling more units against the sacrifice of a lower price.**

There will be an industry-wide equilibrium when both firms resolve this balance.

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Symmetrically, Crystal's *best response* $R_C[Q_S]$ to a conjectured production level of Q_S from Spring should be:

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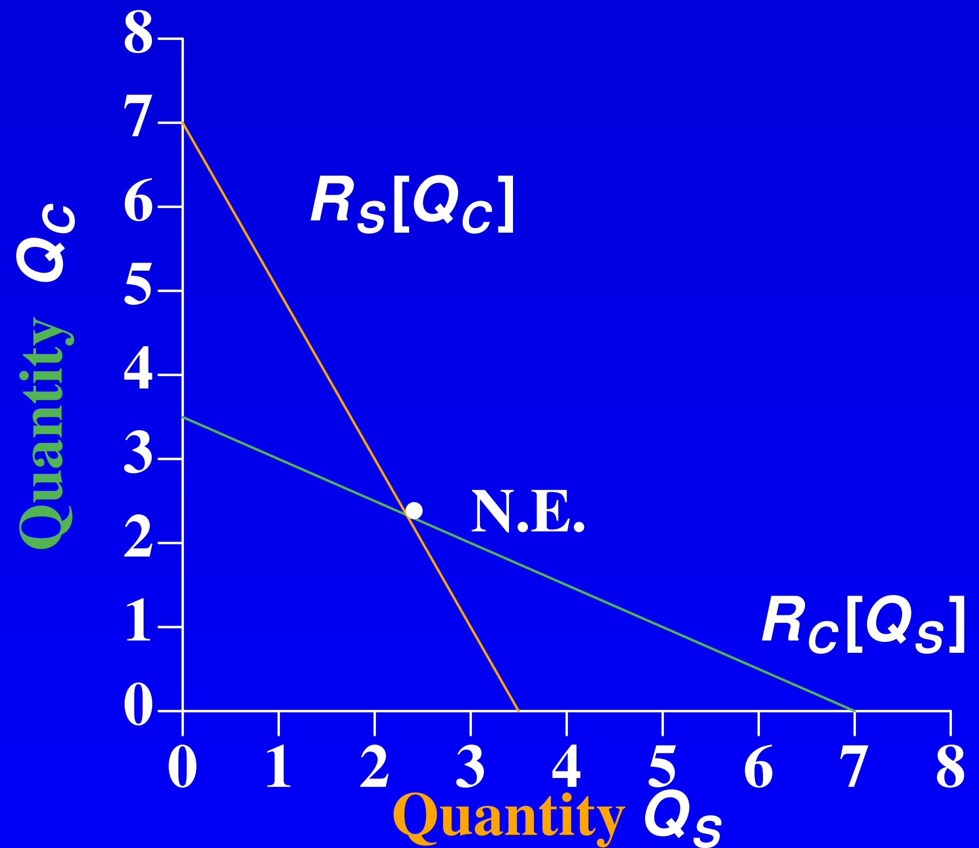

The Two Best-Reponse Curves: Cournot

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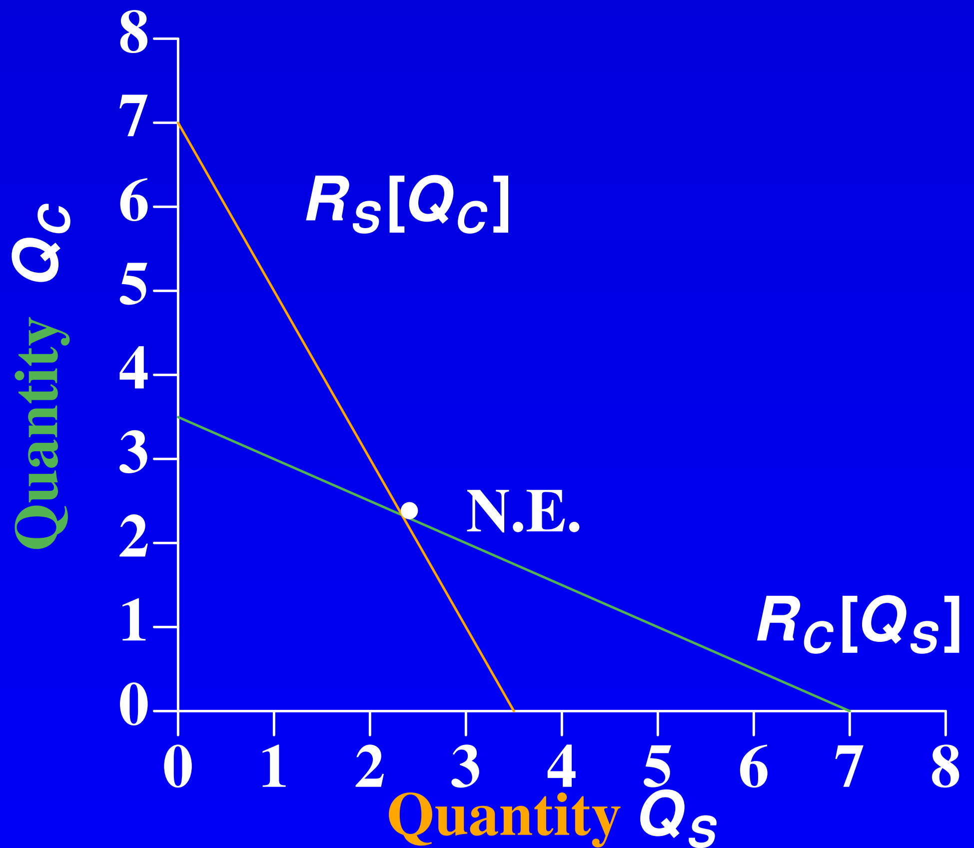

The Two Best-Reponse Curves: Cournot
Strategic substitutes: higher Q_1 ☞ lower Q_2

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Price/unit = \$5$\tfrac{1}{3}$, profit of each = \$5.44

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It costs \$6 to make each pizza.

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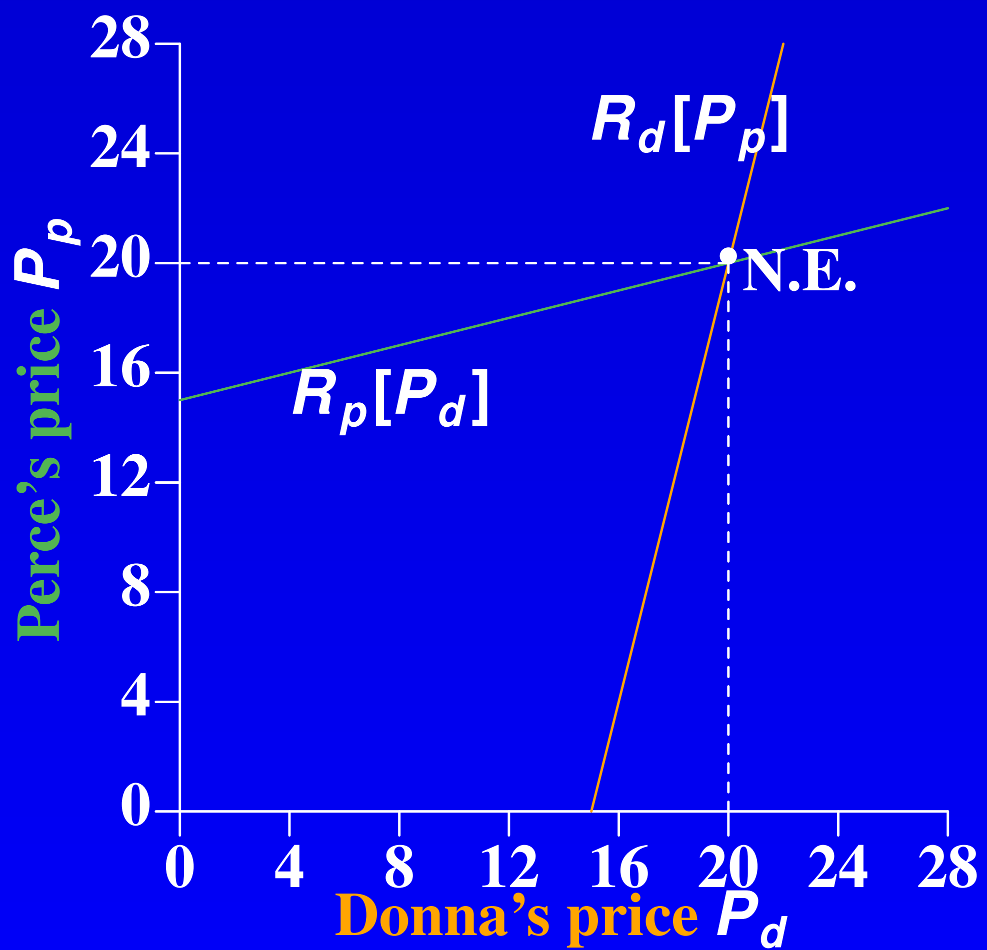

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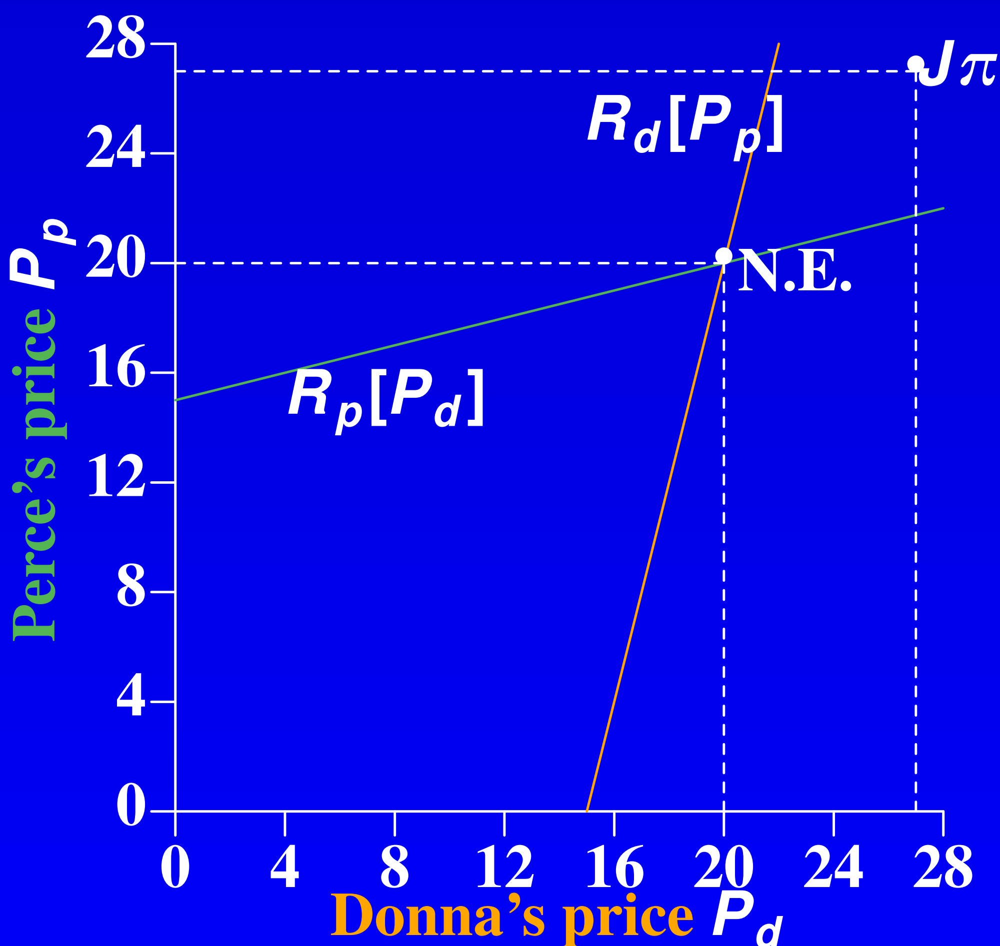

The Two Best-Response Curves (Reaction Functions): Bertrand

(*Strategic complements:*, as P_p rises, so does P_d.)

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∴ a shop that increases its price is helping increase the profits of its rival, but this side-effect is uncaptured (and so ignored) by each shop independently.

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Note: if the market demands were *not* symmetric, then it would be wrong to charge the same price P for both pizzas. Need to choose the two prices to max $\pi = \pi_d + \pi_p$.

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Compare the Cournot and Bertrand duopoly profits below.

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Two companies produce homogeneous output.

Linear industry demand curve of $P = 10 - Q$,
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6. Comparison Tables and Figures.

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Since $P_{PC} = AC$, their profits are zero: $\pi_1 = \pi_2 = 0$.

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> **Each produces output $y_1 = y_2 =$ 2.25 units, and earns $\pi_1 = \pi_2$ = $10.125 profit.**

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So $Q_{Co} = 6$ units, price P_{Co} is then \$4/unit, and the profit of each firm is \$9.

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Profits are $\pi_1 = \$10.125$ (the same as in the cartel case 2. above) and $\pi_2 = \$5.063$ (half the cartel profit).

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Remember: Equilibrium means there is no incentive for either firm to undercut the other.

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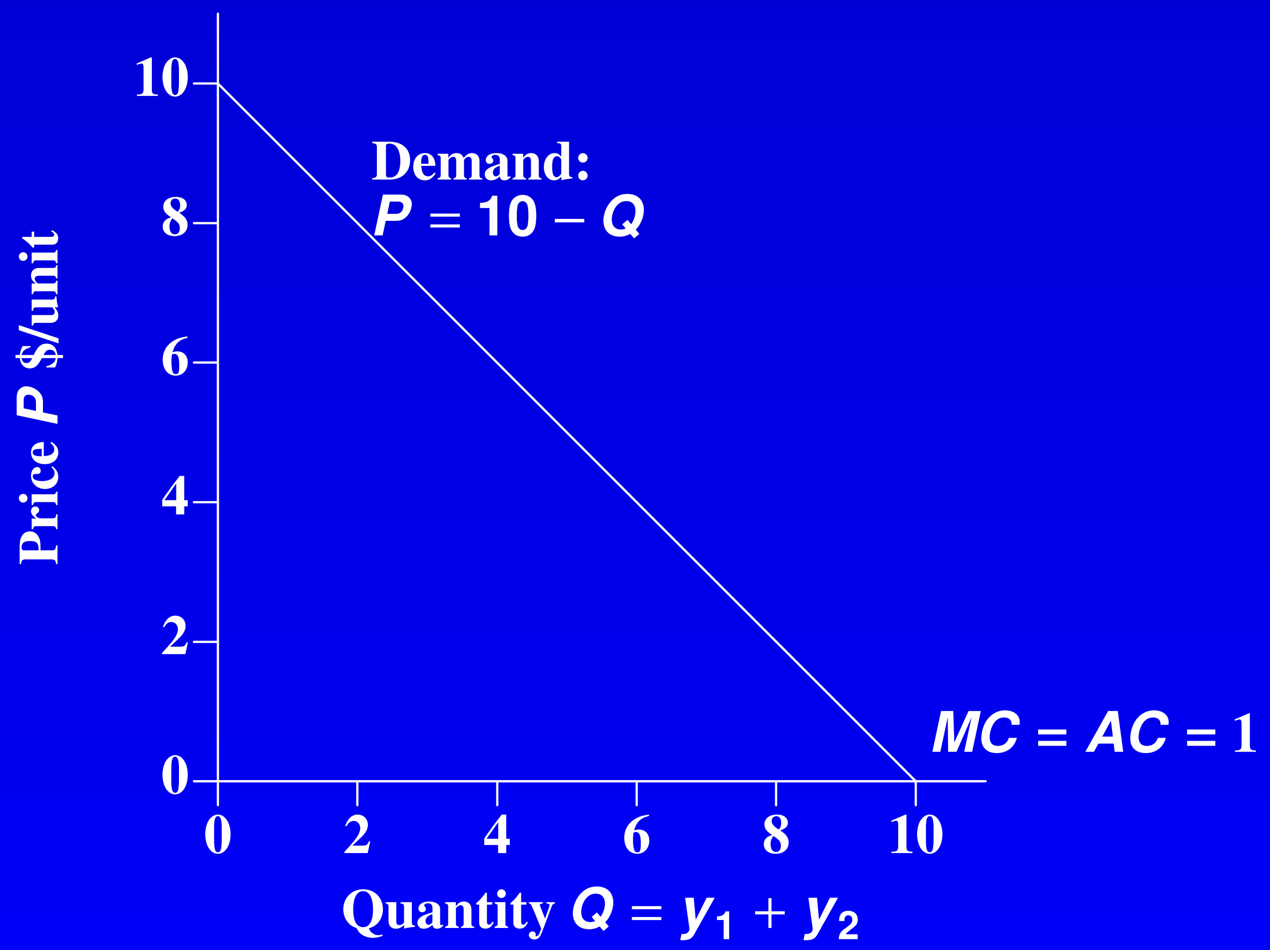
Identical to the price-taking case above.

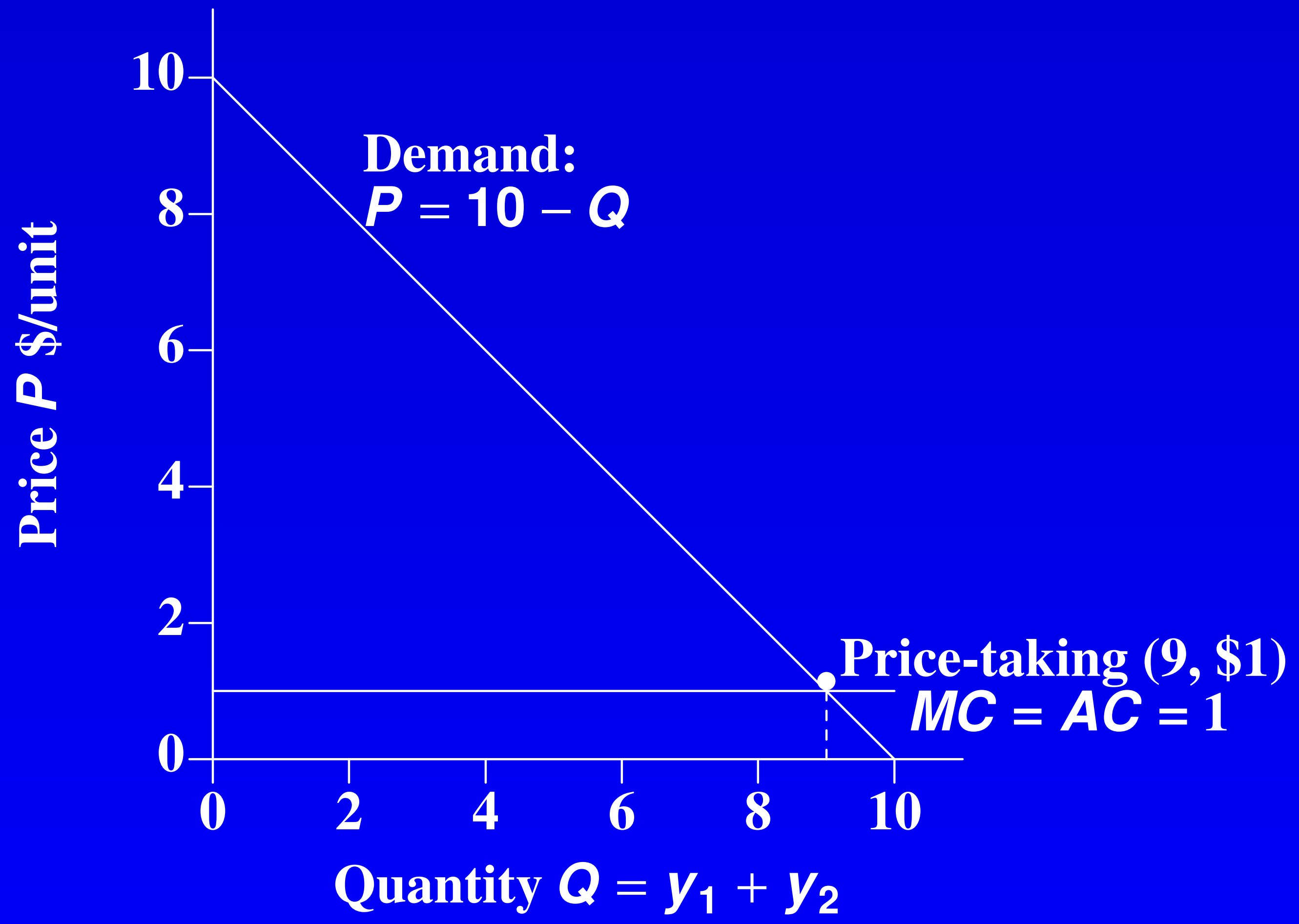
***Note:* Were MC_1 greater than MC_2, then Firm 2 would capture the whole market at a price just below MC_1, and would make a positive profit; and $y_1 = 0$.**

6 Comparing the Five Market Types

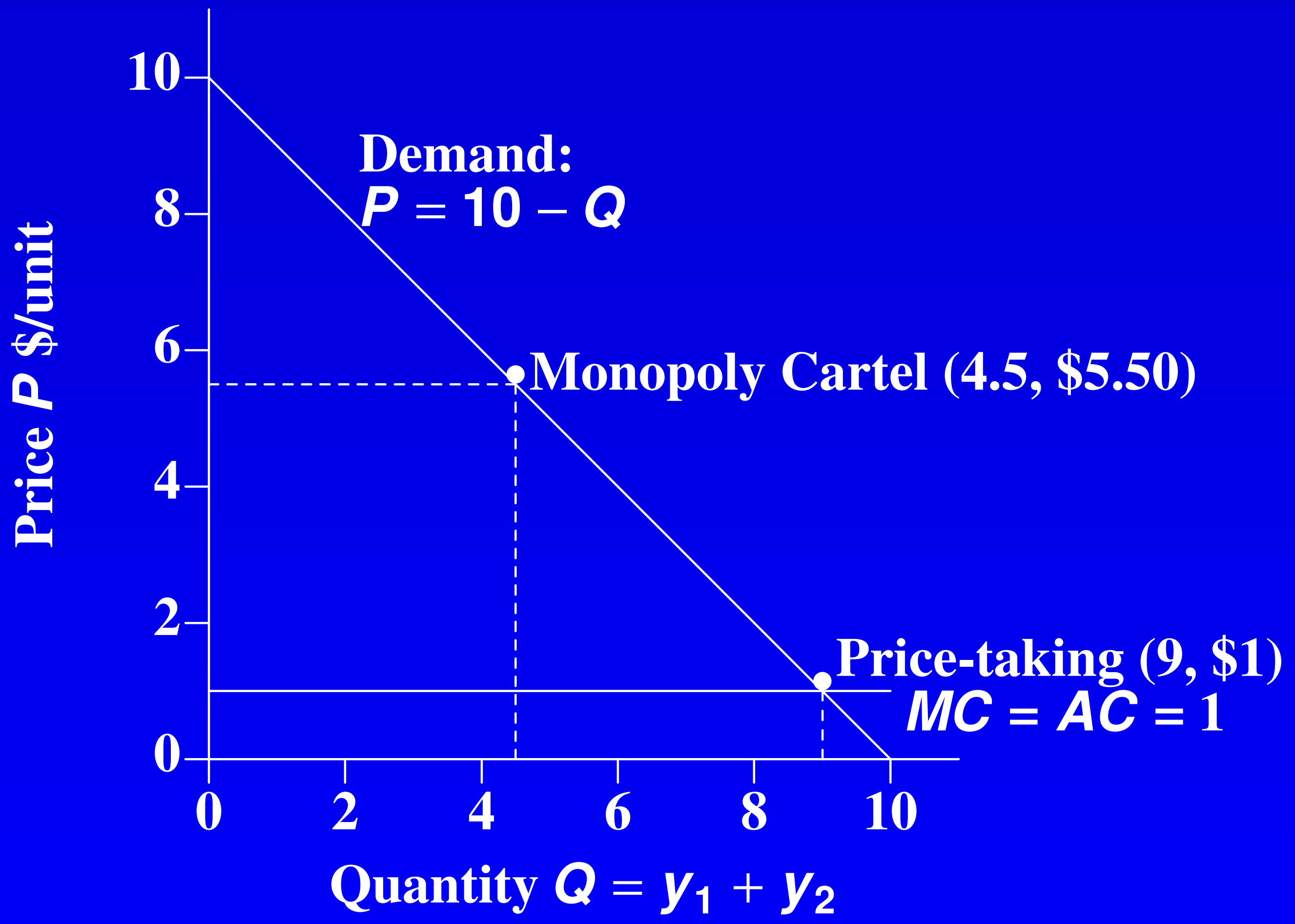
Market	Output y_1	Profit π_1	Output y_2	Profit π_2	Price P	Quantity $Q = y_1 + y_2$
1 Price-taking	4.5	0	4.5	0	1	9
2 Cartel	2.25	10.125	2.25	10.125	5.5	4.5
3 Cournot	3	9	3	9	4	6
4 von Stackelberg	4.5	10.125	2.25	5.063	3.25	6.75
5 Bertrand	4.5	0	4.5	0	1	9

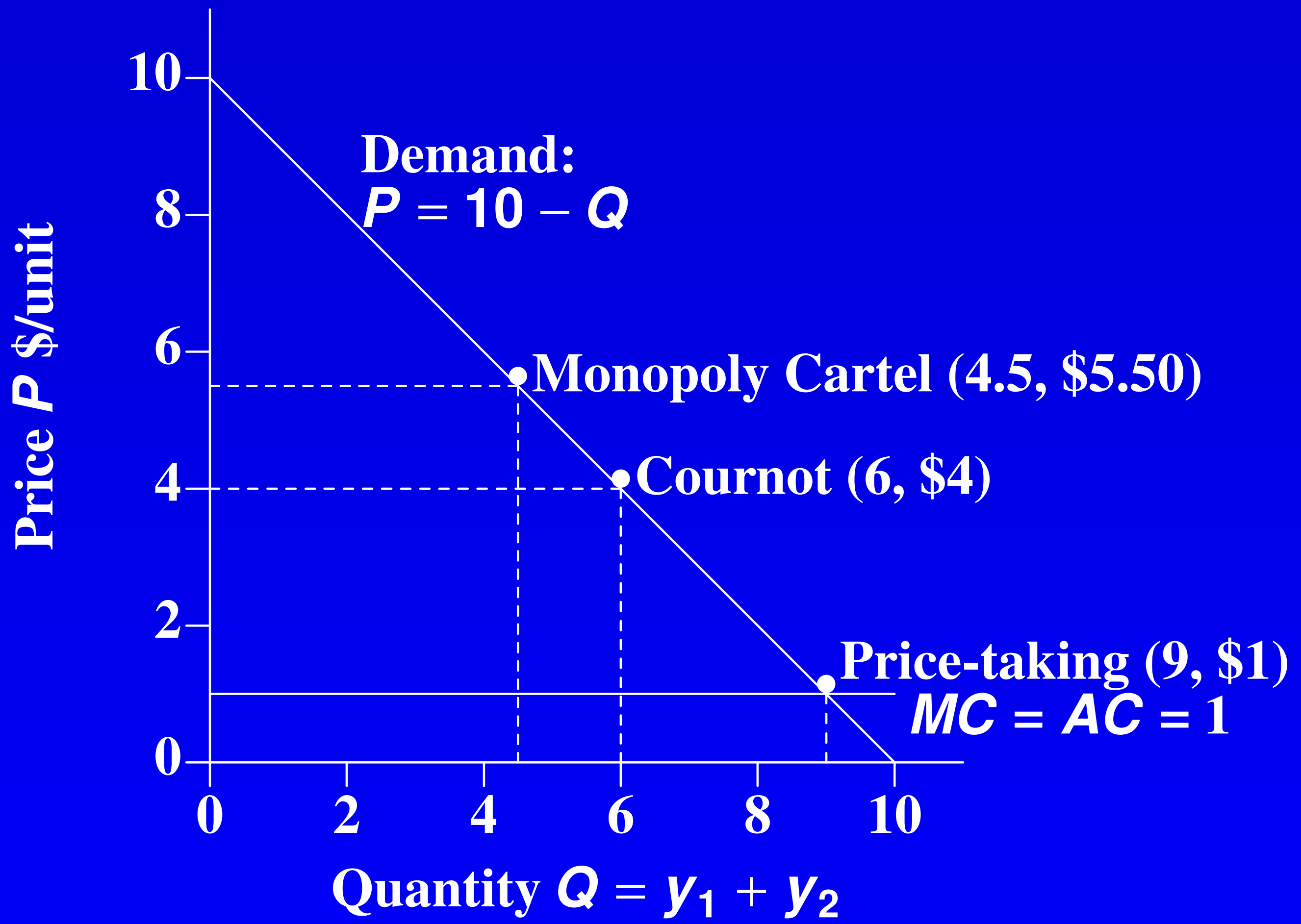
Summary of Outcomes.

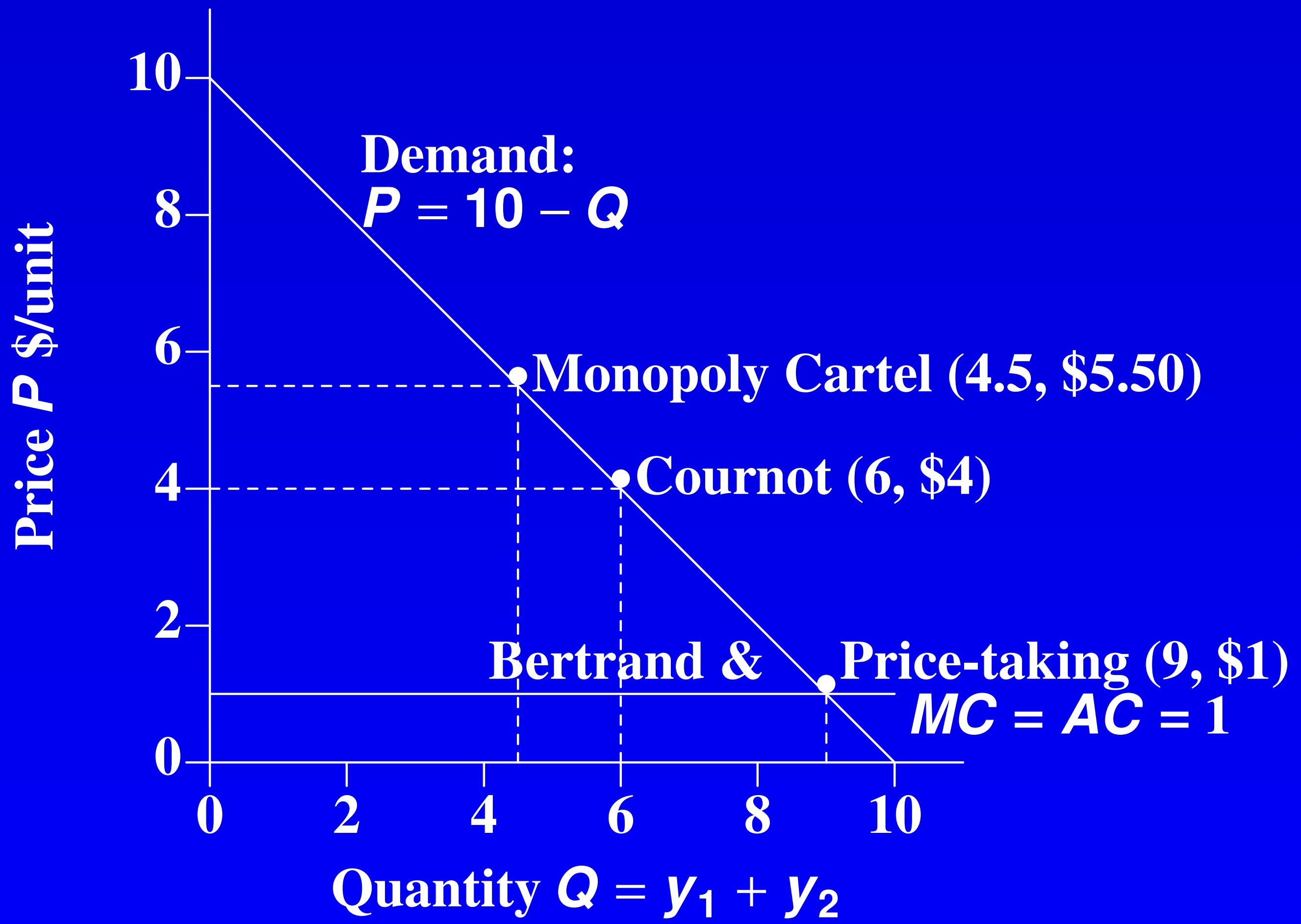

10
8
6
4
2
0
Price P $/unit
Demand:
P = 10 − Q
MC = AC = 1
0
2
4
6
8
10
Quantity Q = y1 + y2



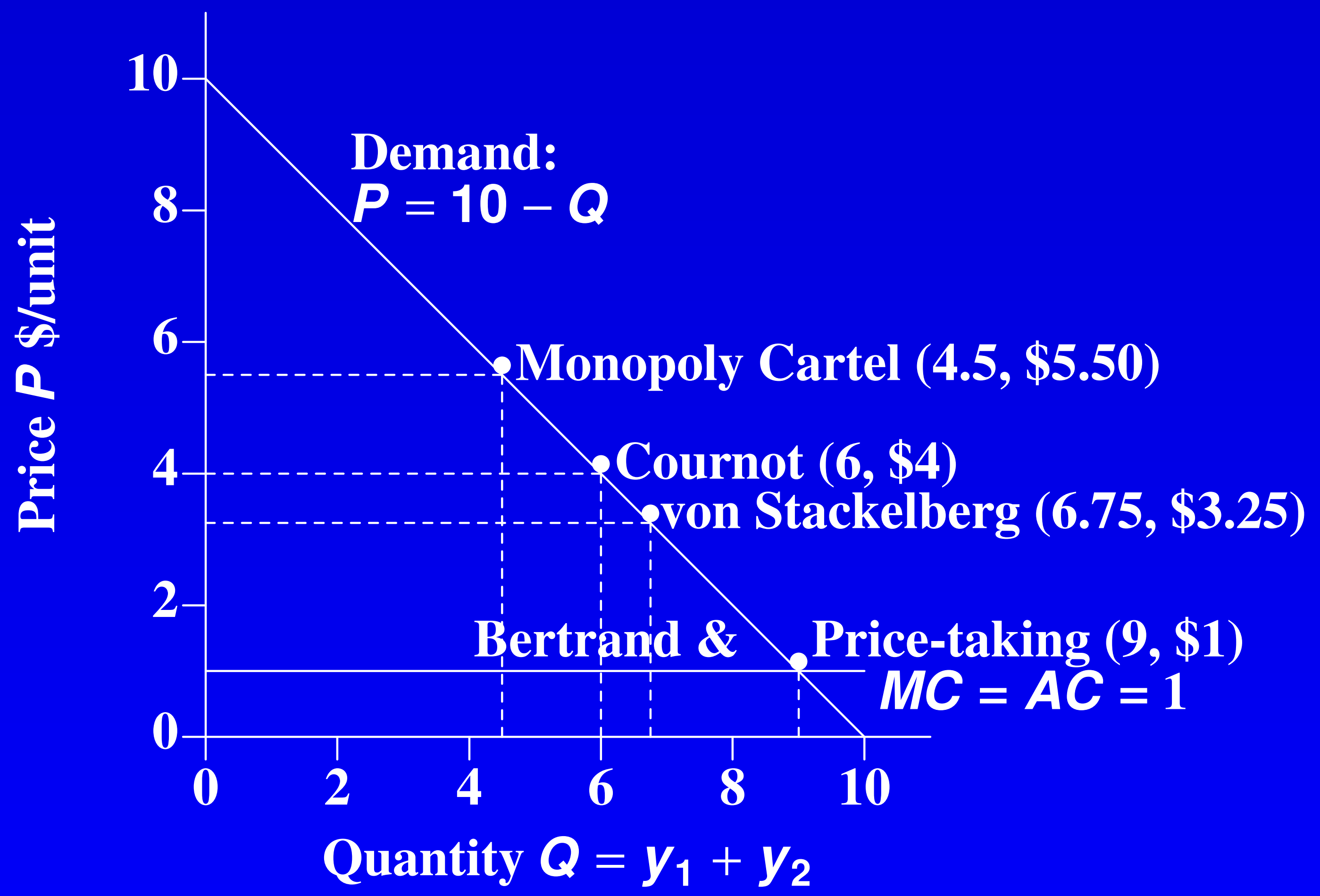
10
8
6
4
2
0
Price P $/unit
Demand:
P = 10 − Q
Price-taking (9, $1)
MC = AC = 1
0
2
4
6
8
10
Quantity Q = y1 + y2


10
8
6
4
2
0
Price P $/unit
Demand:
P = 10 − Q
Monopoly Cartel (4.5, $5.50)
Price-taking (9, $1)
MC = AC = 1
0
2
4
6
8
10
Quantity Q = y1 + y2


10
8
6
4
2
0
Price P $/unit
Demand:
P = 10 − Q
Monopoly Cartel (4.5, $5.50)
Cournot (6, $4)
Price-taking (9, $1)
MC = AC = 1
0
2
4
6
8
10
Quantity Q = y1 + y2



10
8
6
4
2
0
Price P $/unit
Demand:
$P = 10 - Q$
Monopoly Cartel (4.5, $5.50)
Cournot (6, $4)
Bertrand & Price-taking (9, $1)
$MC = AC = 1$
0
2
4
6
8
10
Quantity $Q = y_1 + y_2$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Bertrand &
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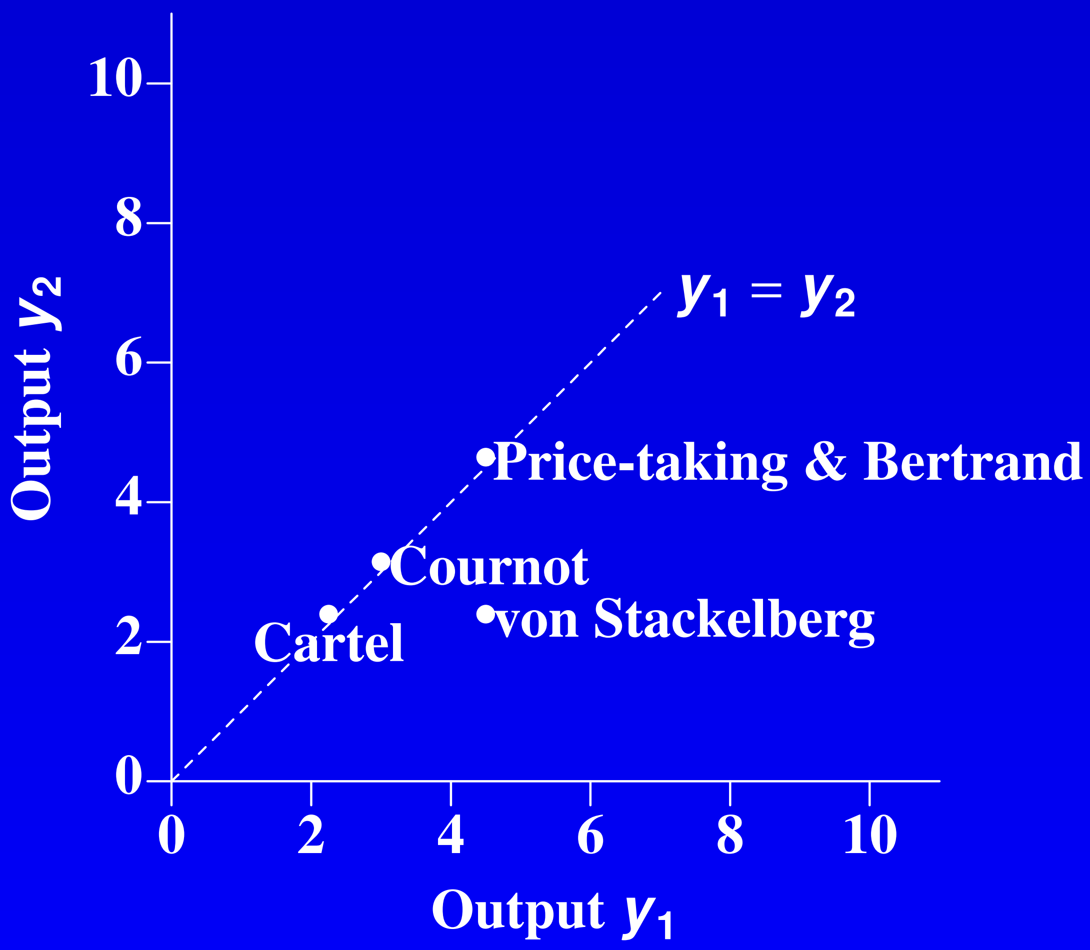
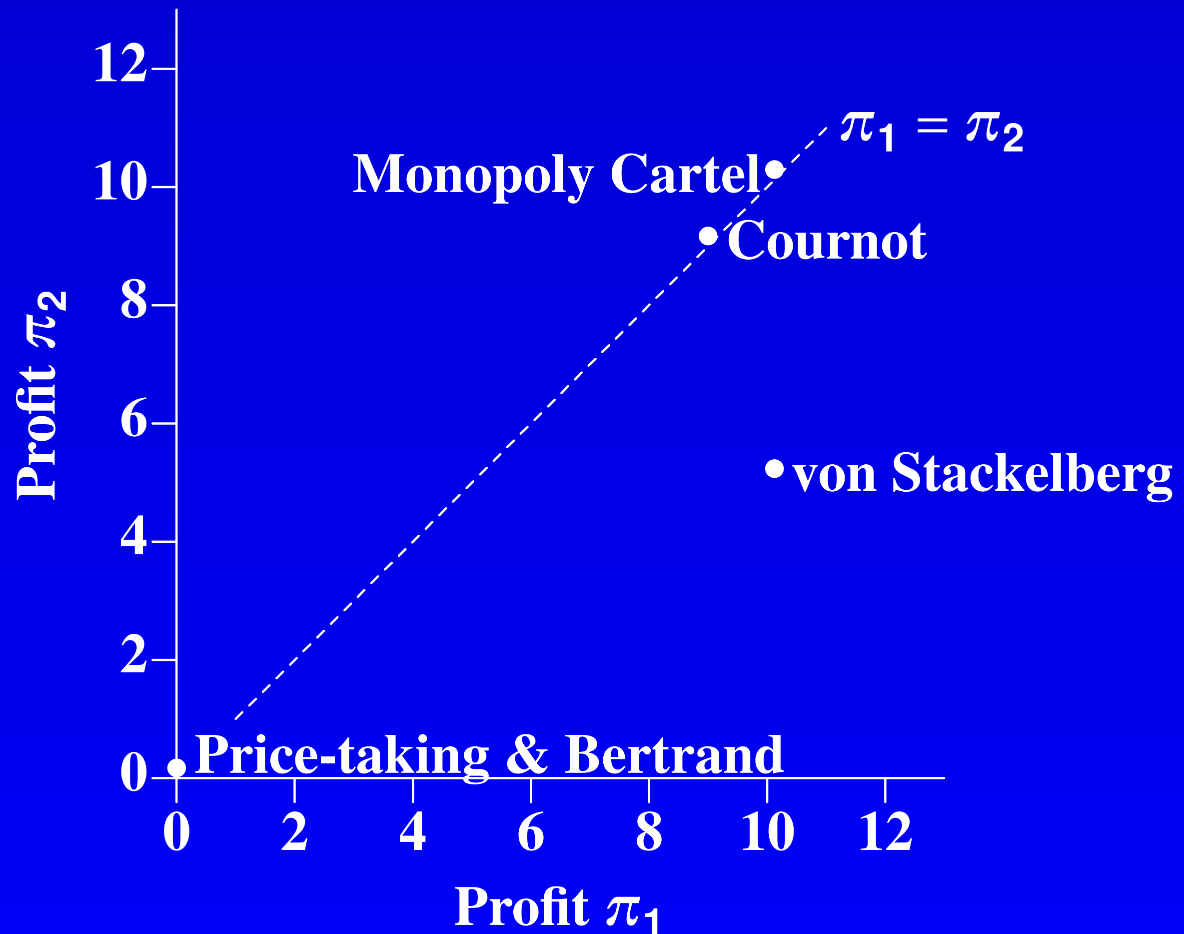
10
8
6
4
2
0
0
2
4
6
8
10
Quantity Q = y1 + y2



10
8
6
4
2
0
Output y_2
$y_1 = y_2$
Price-taking & Bertrand
Cournot
von Stackelberg
Cartel
0
2
4
6
8
10
Output y_1



Profit π_2
12
10
8
6
4
2
0
$\pi_1 = \pi_2$
Monopoly Cartel
Cournot
von Stackelberg
Price-taking & Bertrand
0
2
4
6
8
10
12
Profit π_1