LISBOA SCHOOL OF ECONOMICS & MANAGEMENT

ISEG SINCE 1911

lecture 6:
competition and collusion

the story so far

Natural monopoly:

- Definitions
- (Ideal) Pricing solutions
- Regulation in practice
- Regulation under asymmetric information

outline

Competition and antitrust

- Introduction
- Oligopoly and Collusion

References

- VHV, ch. 3, 5

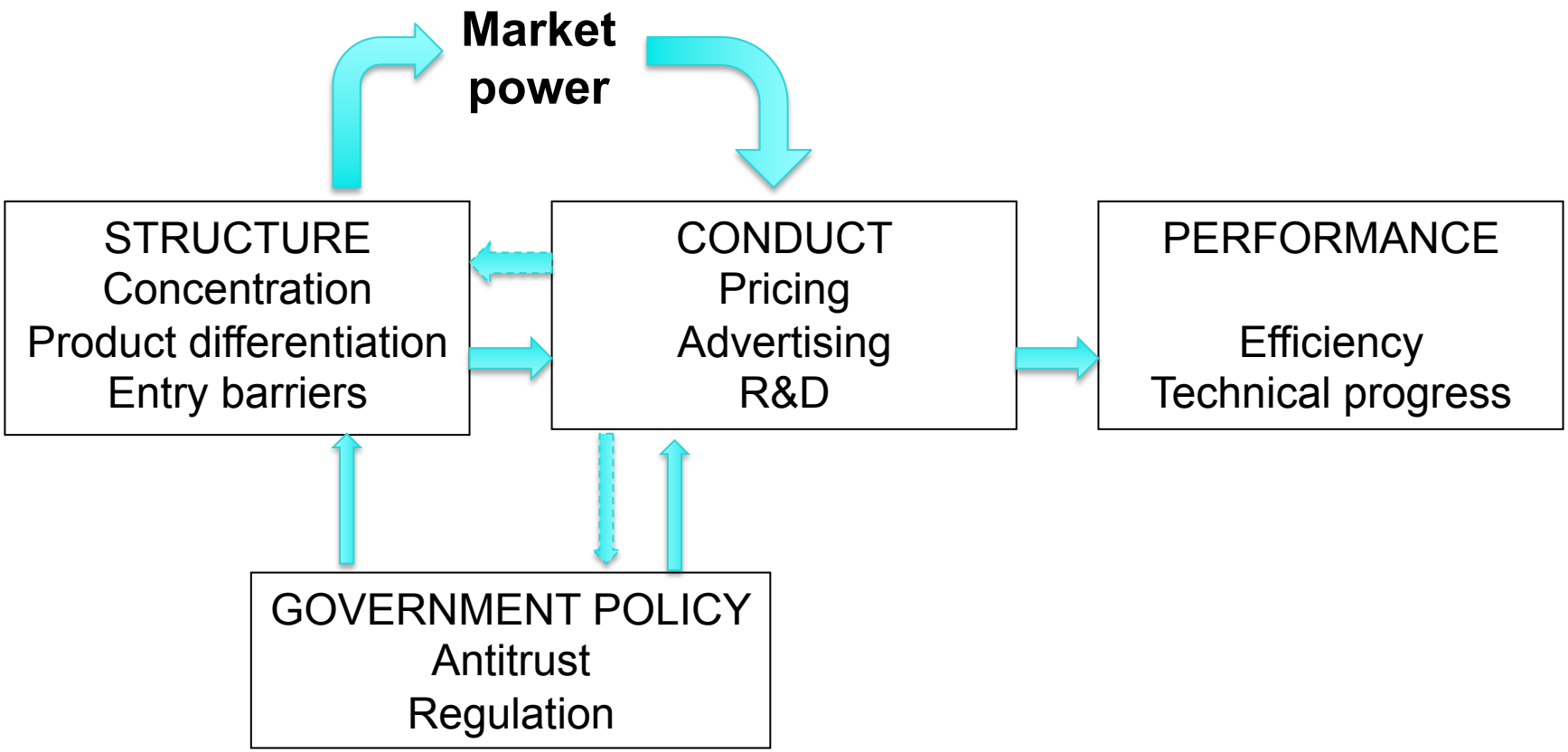
Regulation vs. competition policy

Economic regulation: for industries in which effective competition is not an immediately available alternative to the existing market structure; e.g. the so-called network industries (electricity, telecomunications, railway etc..)

Competition Policy: when competition is the primary mechanism, but still some constraints have to be imposed on firms' behavior (**antitrust law and policy**)

(eliminate impediments to competion, making on-going government intervention unnecessary)

Structure-conduct-performance paradigm of IO



Structure

- Many IO models assume sellers of equal size
- The concept of *concentration* takes into account the number of firms, but also how sales are distributed among firms

Concentration

- Herfindahl-Hirschman index

$$HHI = \sum_{i=1}^{N} s_i^2$$

- Concentration ratios

$$CR_m = \sum_{i=1}^{m} s_i$$

Concentration
example

- Percentage of sales in Industries X and Y:

Firm	Industry X	Industry Y
1	20	60
2	20	10
3	20	5
4	20	5
5	20	5
6		5
7		5
8		5
9		5

- Which one is more concentrated?

Concentration
example

- $CR_{3Y} > CR_{3X}$, but $CR_{5Y} < CR_{5X}$
- $HHI_Y = 60^2 + 10^2 + 6 * 5^2 = 3850$ and $HHI_X = 20^2 + 20^2 + 20^2 + 20^2 + 20^2 = 2000$

Concentration
example 2

- The four-firm concentration ratio for the airline industry in the United States was 61 in 1990

- That is, the market shares of the top four firms were:

American	18%
United	17%
Delta	14%
Northwest	12%
Total	61%

Concentration
example 2

- Concentration is a better measure of the size distribution of sellers because it gives weight to the inequality of sizes.

- Otherwise, a simple count of sellers would weight American equally with, say, Southwest, which had only 2 percent of the market in 1990

Entry conditions

- Ease with which a new firm enters an industry
- Depends on:
  - cost of entry
  - advantage of incumbent firms (for being there first)
- Entry barrier:
  - Def: something that makes entry more costly or more difficult
  - Important in that they permit existing firms to charge prices above the competitive level without attracting entry
  - Ex: patent

Entry barriers

- Different opinions

- Examples:
  - Patent holder on a drug
  - Potential entrants into an industry have absolutely higher costs for all output levels than established firms
  - Economies of scale that are large relative to the total market demand constitute an entry barrier
  - Strong brand loyalties created through intensive advertising have been cited as an entry barrier to new firms

Structure

- Product differentiation is another source of market power
- In markets where the product is homogeneous, e.g., wheat, steel, oil,..., price is the primary basis for competition
- Differentiated products, e.g., breakfast cereals, autos, soft drinks, beer, and medicines, are less likely to be sold primarily on a price basis (advertising and product design are important)
- Product differentiation influences the character of competitive tactics

Conduct

- Conduct refers to decisions regarding price, quantity, advertising, R&D, capacity, design, product differentiation,...

- Two states:

1. Collusion: forms of coordination among firms, in particular raising price
    1. Explicit
    2. Tacit
2. Competition

- Industries differ in the intensity and instruments of competition

Performance

- (Static) Efficiency
- Technical progress
- Other dimensions, only marginally influenced by antitrust policy: full employment of resources, fair distribution of income,...

Government

- Affects market structure…
- Ex: an antitrust decision may lead to dissolving a monopoly
- And market performance
- Ex: an antitrust decision may affect prices

Structures

- Perfect competition

- Monopoly: single seller (>P; <Q)
- Monopsony: single buyer (<P; <Q)

- Oligopoly: small number of firms (>P; <Q)
- Oligopsony: small groups of buyers (<P; <Q)

- Monopolistic (imperfect) competition: many sellers, differentiated product

Nash equilibrium

- A profile of strategies is a Nash equilibrium iff each player's strategy is a best response to the other players' strategies

Cournot duopoly

- Two identical firms 1 and 2
- Both set quantities assuming that the conjectural variation is zero (e.g., firm 1 assumes $dq_2/dq_1=0$)
- Nash equilibrium occurs when a firm does not want to change its output having observed its rival's output

Cournot duopoly

example

- $P = 25 - (q_1 + q_2)$;
- $C_1 = 5q_1$;
- $C_2 = 5q_2$.

- Best response functions:

$$q_1 = (20 - q_2)/2 \text{ and } q_2 = (20 - q_1)/2$$

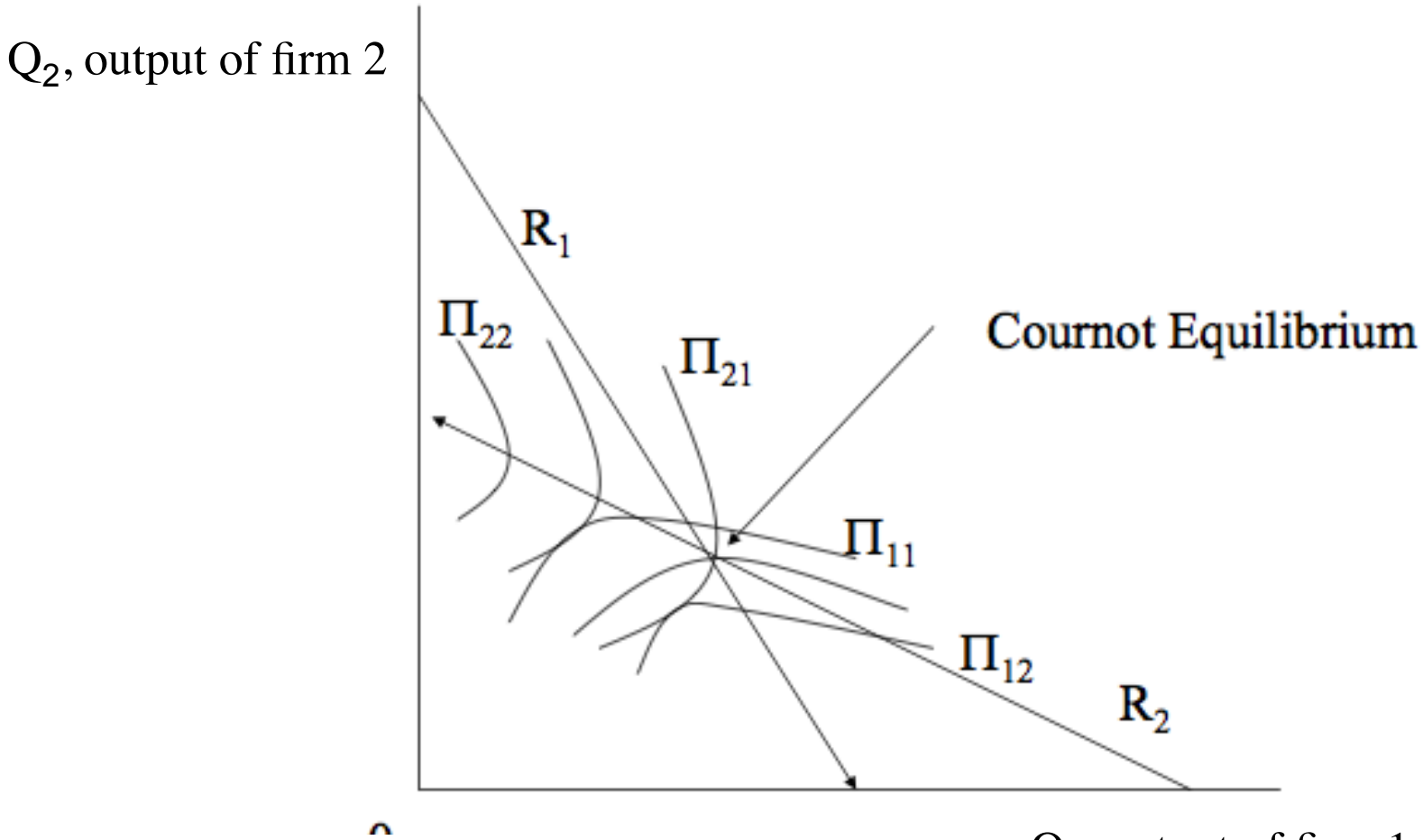
- Solution:

$$q_1 = q_2 = 20/3;\ P = 35/3;\ \Pi_1 = \Pi_2 = 400/9 = 44;$$

$$CS = PS = 800/9;\ TS = 1600/9$$

Cournot duopoly

example



$\Pi_{2!} < \Pi_{22}$; $\Pi_{11} < \Pi_{12}$

Cournot oligopoly

- $Q = q_1 + q_2 + \ldots + q_n$
- MR = MC for each firm i
- $\Pi_i = P(Q).q_i - C(q_i)$

- Solution:

$$(P\text{-}MC_i)/P = s_i/\eta$$

where s_i is firm i's market share and η is price-elasticity of demand

Duopoly as a normal form game

1 \ 2	S1=5	S2=20/3	S3=10
S1=5	(50,50)	(42,55)	(25,50)
S2=20/3	(55,42)	(44,44)	(22,33)
S3=10	(50,25)	(33,22)	(0,0)

(S_2, S_2) is the Nash equilibrium
(S_1, S_1) is the collusive equilibrium
S_3 is dominated

Duopoly as a prisoners' dilemma

1 \ 2	S1=5	S2=20/3
S1=5	(50,50)	(42,55)
S2=20/3	(55,42)	(44,44)

The prisoners' dilemma

2 / 1	Don't Confess	Confess
Don't Confess	(10,10)	(2,12)
Confess	(12,2)	(5,5)

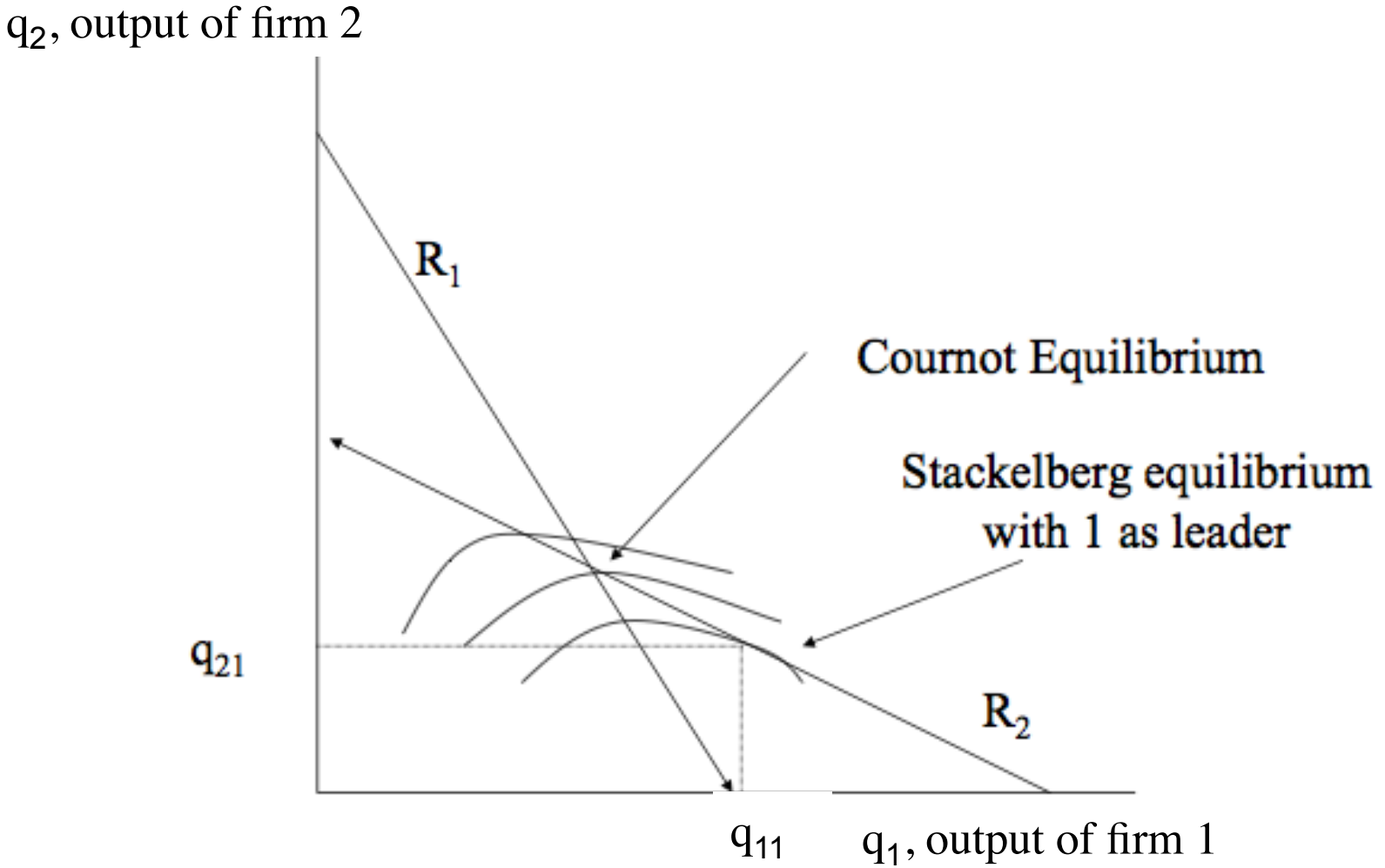
Stackelberg duopoly

- Firm 1 is the leader and firm 2 is the follower
- Firm 1 knows $q_2 = (20-q_1)/2$ and maximizes profits
- Firm 2 plays *a la* Cournot
- Solution:

$$q_1 = 10;\ q_2 = 5;\ P = 10$$

$$\Pi_1 = 50,\ \Pi_2 = 25;\ PS = 75;\ CS = 112.5;\ TS = 187.5$$

Stackelberg duopoly



Bertrand duopoly

- Two identical firms (1 and 2)
- Both set prices assuming the other's choice is independent of its own, i.e., the conjectural variation of price is 0
- Equilibrium occurs when each firm does not want to change its price after having observed what price the other firm has set
- P = MC (= AC)
- Profits are 0

Bertrand with differentiated products

- Firms 1 and 2 produce similar but not identical products and compete on price
- Demands: $q_1 = 20 - p_1 + p_2$; $q_2 = 20 - p_2 + p_1$
- Assume MC = 0
- Price reaction functions:

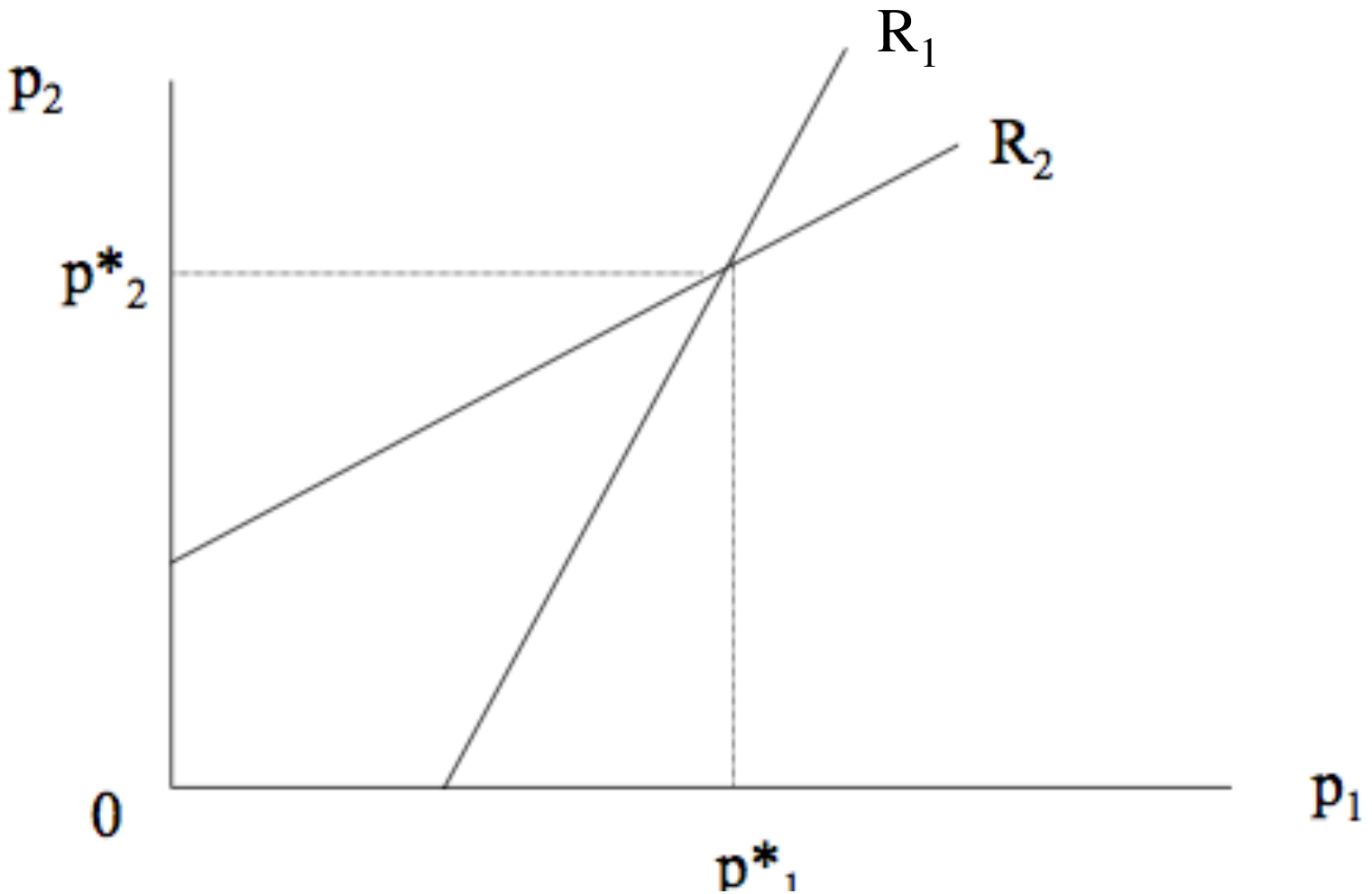
$$p_1 = (20 + p_2)/2;\ p_2 = (20 + p_1)/2$$

$$p_1 = p_2 = 20;\ \Pi_1 = \Pi_2 = 400$$

- If firm 1 is leader,

$$p_1 = 30;\ p_2 = 25;\ \Pi_1 = 450;\ \Pi_2 = 625$$

Bertrand equilibrium



Cournot and collusion

- Collusion involves a non-zero conjectural variation: there is coordination st $dq_2/dq_1 > 0$
- Coordination of output may result from an agreement (cooperative behavior) or as a result of indefinite repetition or irrational commitments
- In the Cournot example, the collusive outcome is P = 15 and $q_1 = q_2 = 5$, with firm profits of 50. If with cheating the Cournot outcome appears, firms get 44
- Firm 1 compares 1-period gain with multi-period loss: gain is 5 and loss is $6\delta/(1-\delta)$; so, cheat if $\delta < 5/11$ and sustain collusion if $\delta \geq 5/11$

Collusion
in general

- Incentive constraints: immediate gain from deviation vs. lost future profits and importance of future

$$\pi_i^c + \delta V_i^c \geq \pi_i^d + \delta V_i^p, i = 1,\ldots,n$$

Or: collusion occurs if discount factor is high enough:

$$\delta \geq \frac{\pi_i^d - \pi_i^c}{V_i^c - V_i^p} \equiv \overline{\delta}_i, i = 1,\ldots,n$$