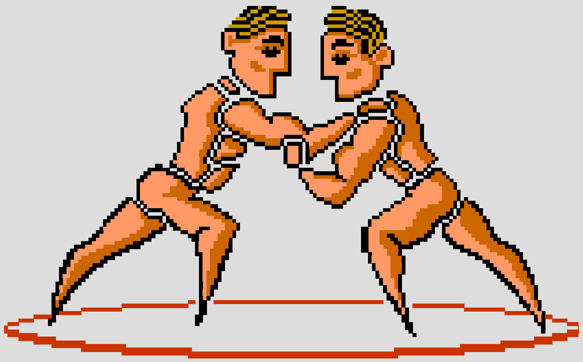
Managerial Economics & Business Strategy

Chapter 9

Basic Oligopoly Models



Overview

I. Conditions for Oligopoly?

II. Role of Strategic Interdependence

III. Profit Maximization in Four Oligopoly Settings

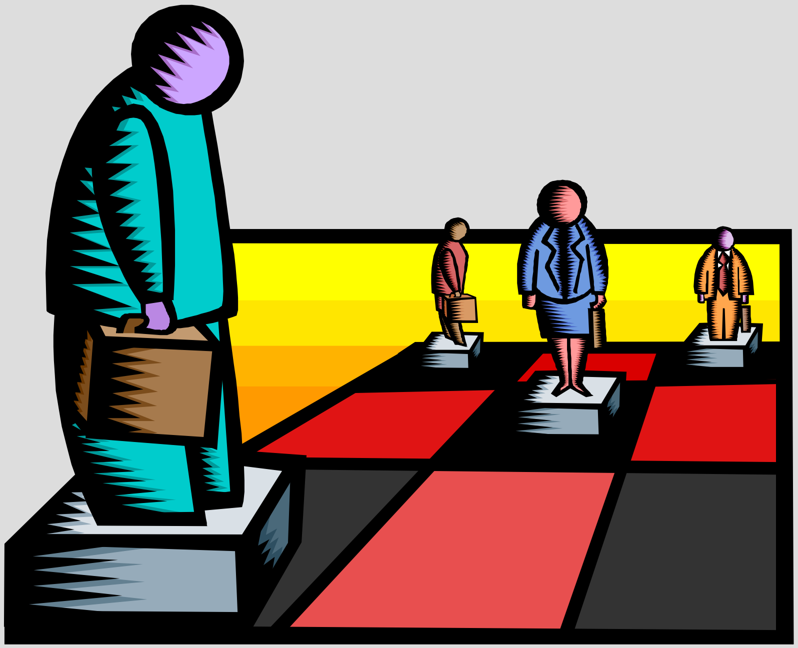
- Sweezy (Kinked-Demand) Model
- Cournot Model
- Stackelberg Model
- Bertrand Model

IV. Contestable Markets

Oligopoly Environment

- Relatively few firms, usually less than 10.
  - Duopoly - two firms
  - Triopoly - three firms
- The products firms offer can be either differentiated or homogeneous.

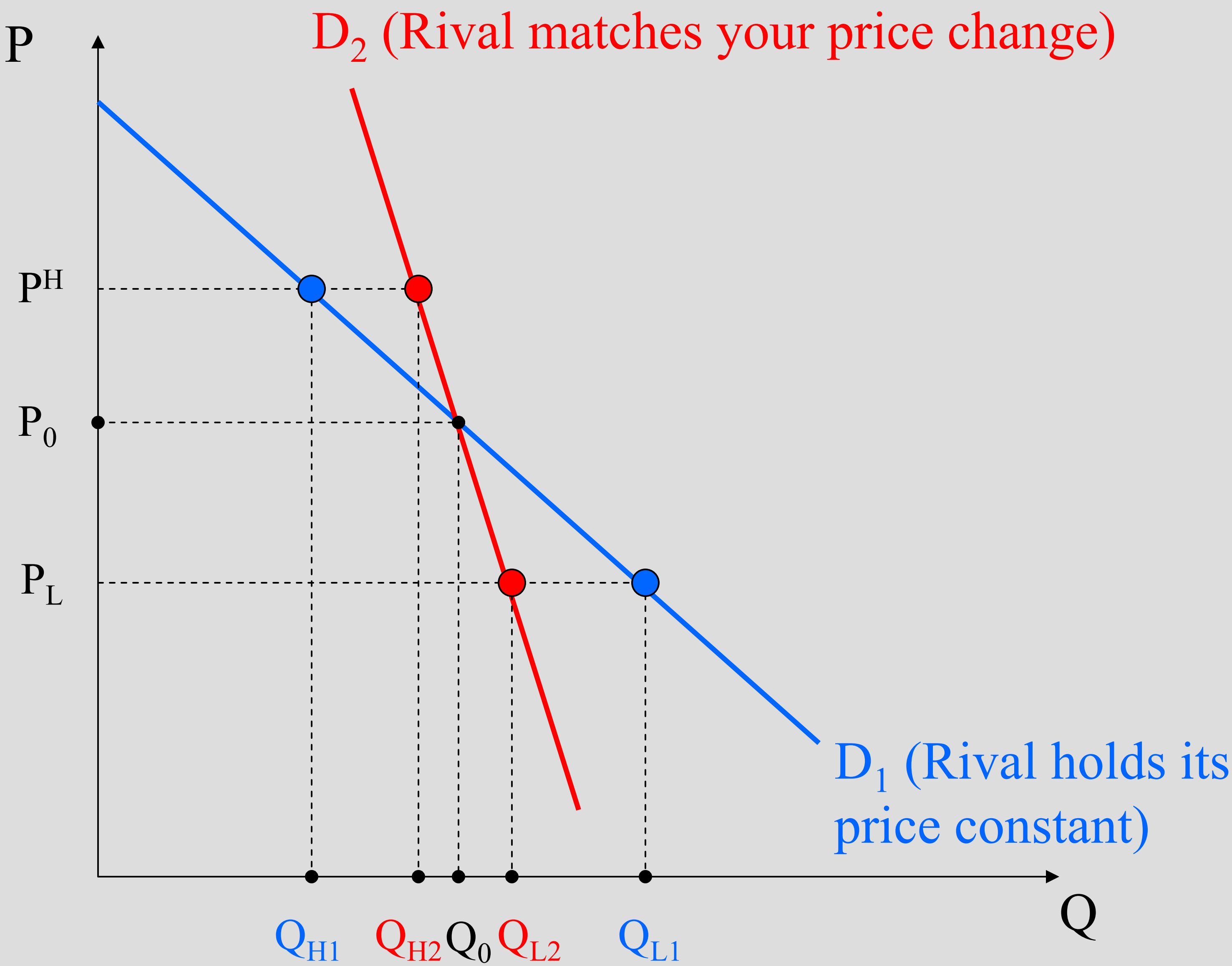
Role of Strategic Interaction

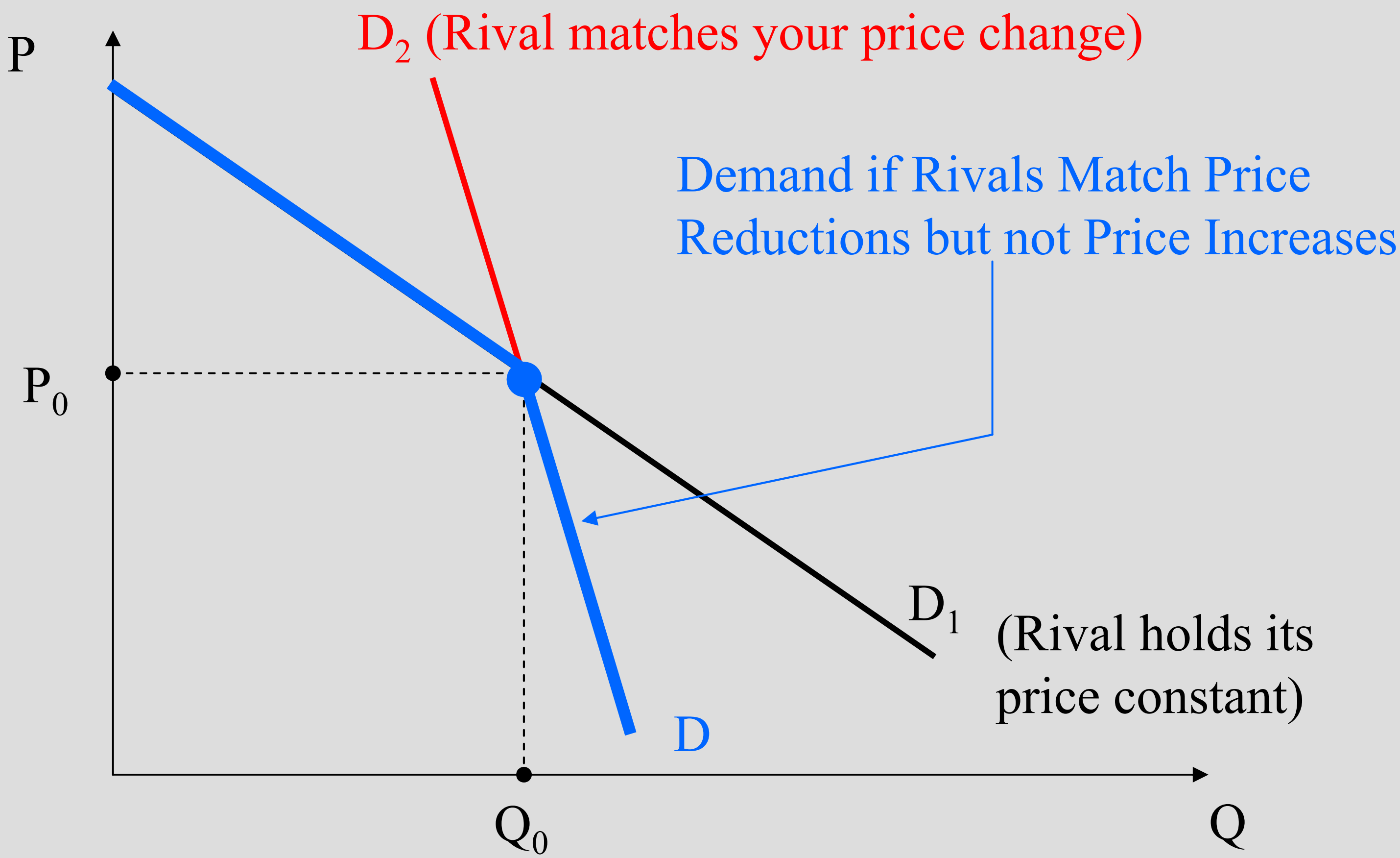


- Your actions affect the profits of your rivals.
- Your rivals' actions affect your profits.

An Example

- You and another firm sell differentiated products.
- How does the quantity demanded for your product change when you change your price?


D2 (Rival matches your price change)
P
PH
P0
PL
D1 (Rival holds its price constant)
Q
QH1
QH2
Q0
QL2
QL1


D2 (Rival matches your price change)
P
Demand if Rivals Match Price Reductions but not Price Increases
P0
D1
(Rival holds its price constant)
D
Q0
Q

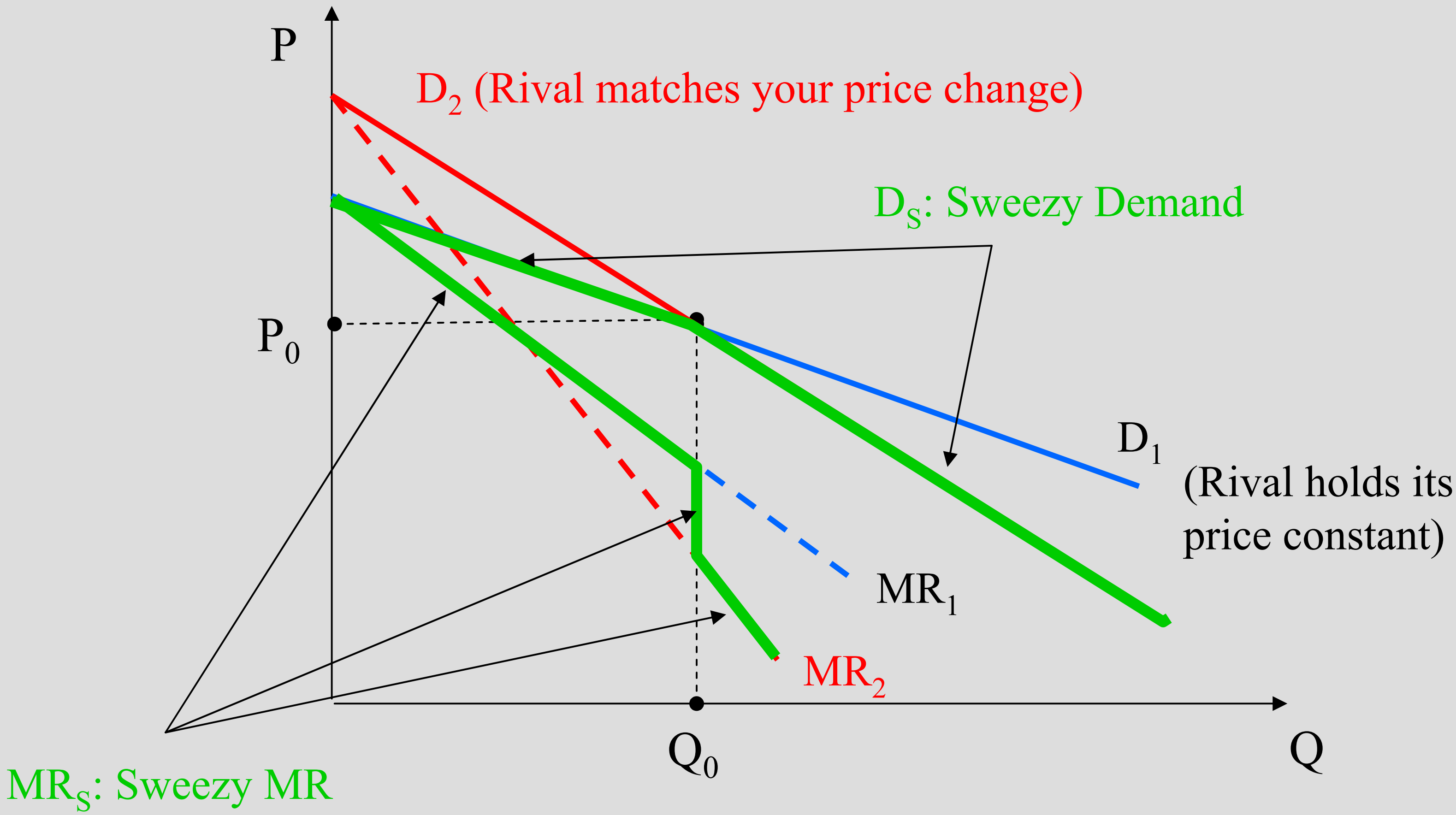
Key Insight

- The effect of a price reduction on the quantity demanded of your product depends upon whether your rivals respond by cutting their prices too!
- The effect of a price increase on the quantity demanded of your product depends upon whether your rivals respond by raising their prices too!
- Strategic interdependence: You aren’t in complete control of your own destiny!

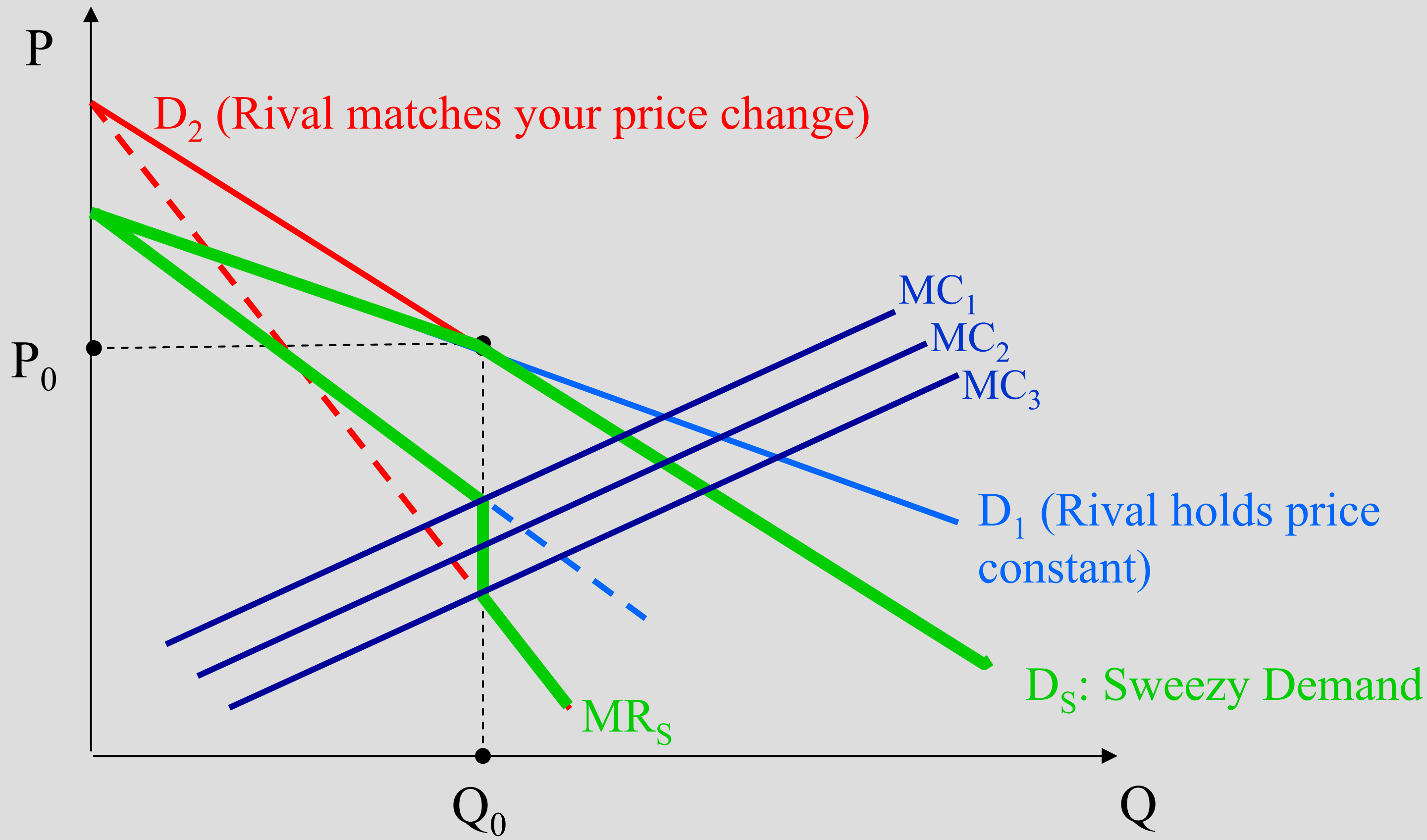
Sweezy (Kinked-Demand) Model

- Few firms in the market serving many consumers.
- Firms produce differentiated products.
- Barriers to entry.
- Each firm believes rivals will match (or follow) price reductions, but won't match (or follow) price increases.
- Key feature of Sweezy Model
  - *Price-Rigidity*.

Sweezy Demand and Marginal Revenue



Sweezy Profit-Maximizing Decision



Sweezy Oligopoly Summary

- Firms believe rivals match price cuts, but not price increases.
- Firms operating in a Sweezy oligopoly maximize profit by producing where

$$MR_S = MC.$$

  - The kinked-shaped marginal revenue curve implies that there exists a range over which changes in MC will not impact the profit-maximizing level of output.
  - Therefore, the firm may have no incentive to change price provided that marginal cost remains in a given range.

Cournot Model

- A few firms produce goods that are either perfect substitutes (homogeneous) or imperfect substitutes (differentiated).
- Firms set output, as opposed to price.
- Each firm believes their rivals will hold output constant if it changes its own output (The output of rivals is viewed as given or “fixed”).
- Barriers to entry exist.

Inverse Demand in a Cournot Duopoly

- Market demand in a homogeneous-product Cournot duopoly is

$$P = a - b(Q_1 + Q_2)$$

- Thus, each firm's marginal revenue depends on the output produced by the other firm. More formally,

$$MR_1 = a - bQ_2 - 2bQ_1$$

$$MR_2 = a - bQ_1 - 2bQ_2$$

Best-Response Function

- Since a firm's marginal revenue in a homogeneous Cournot oligopoly depends on both its output and its rivals, each firm needs a way to "respond" to rival's output decisions.
- Firm 1's best-response (or reaction) function is a schedule summarizing the amount of Q_1 firm 1 should produce in order to maximize its profits for each quantity of Q_2 produced by firm 2.
- Since the products are substitutes, an increase in firm 2's output leads to a decrease in the profit-maximizing amount of firm 1's product.

Best-Response Function for a Cournot Duopoly

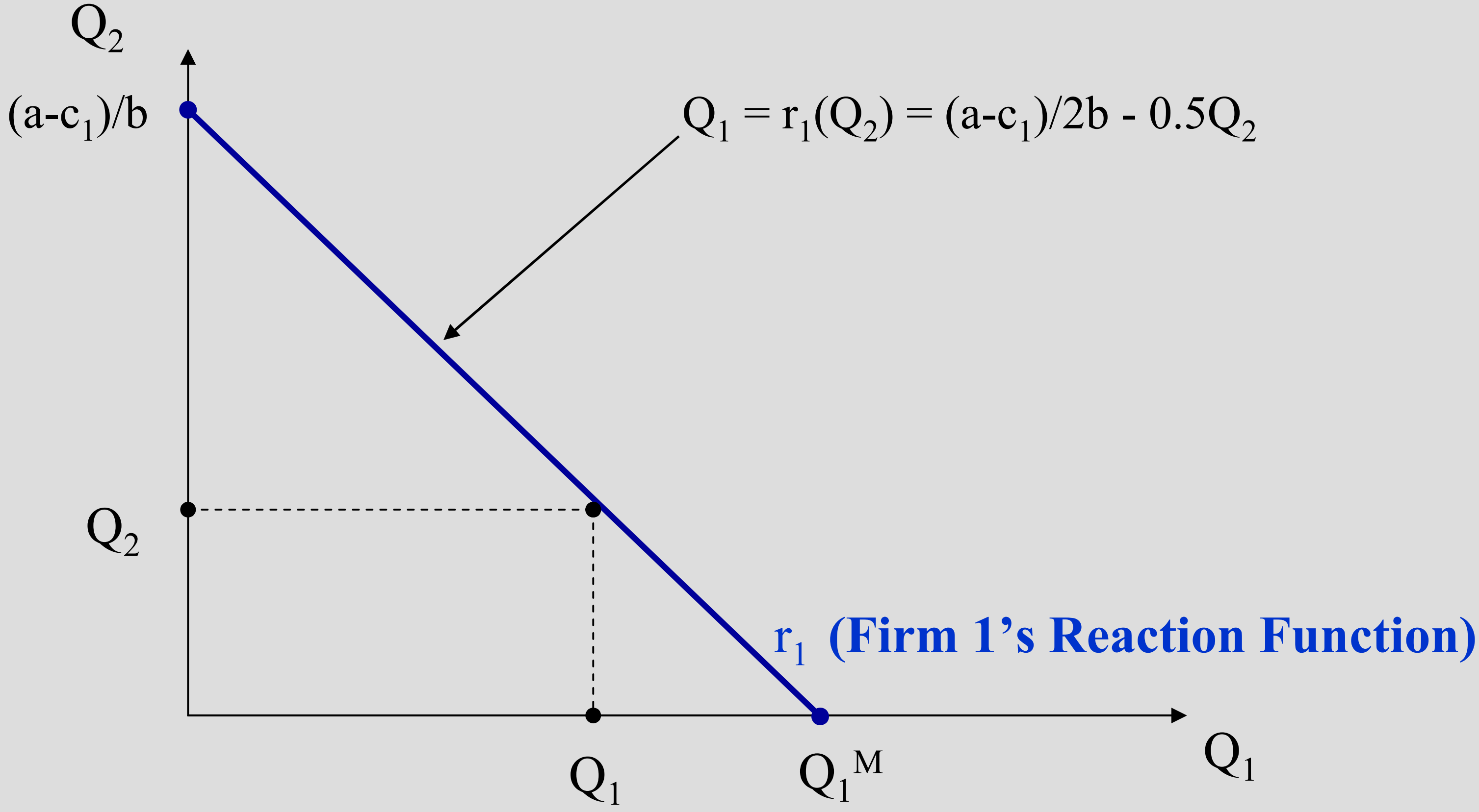
- To find a firm's best-response function, equate its marginal revenue to marginal cost and solve for its output as a function of its rival's output.
- Firm 1's best-response function is (c_1 is firm 1's MC)

$$Q_1 = r_1(Q_2) = \frac{a - c_1}{2b} - \frac{1}{2} Q_2$$

- Firm 2's best-response function is (c_2 is firm 2's MC)

$$Q_2 = r_2(Q_1) = \frac{a - c_2}{2b} - \frac{1}{2} Q_1$$

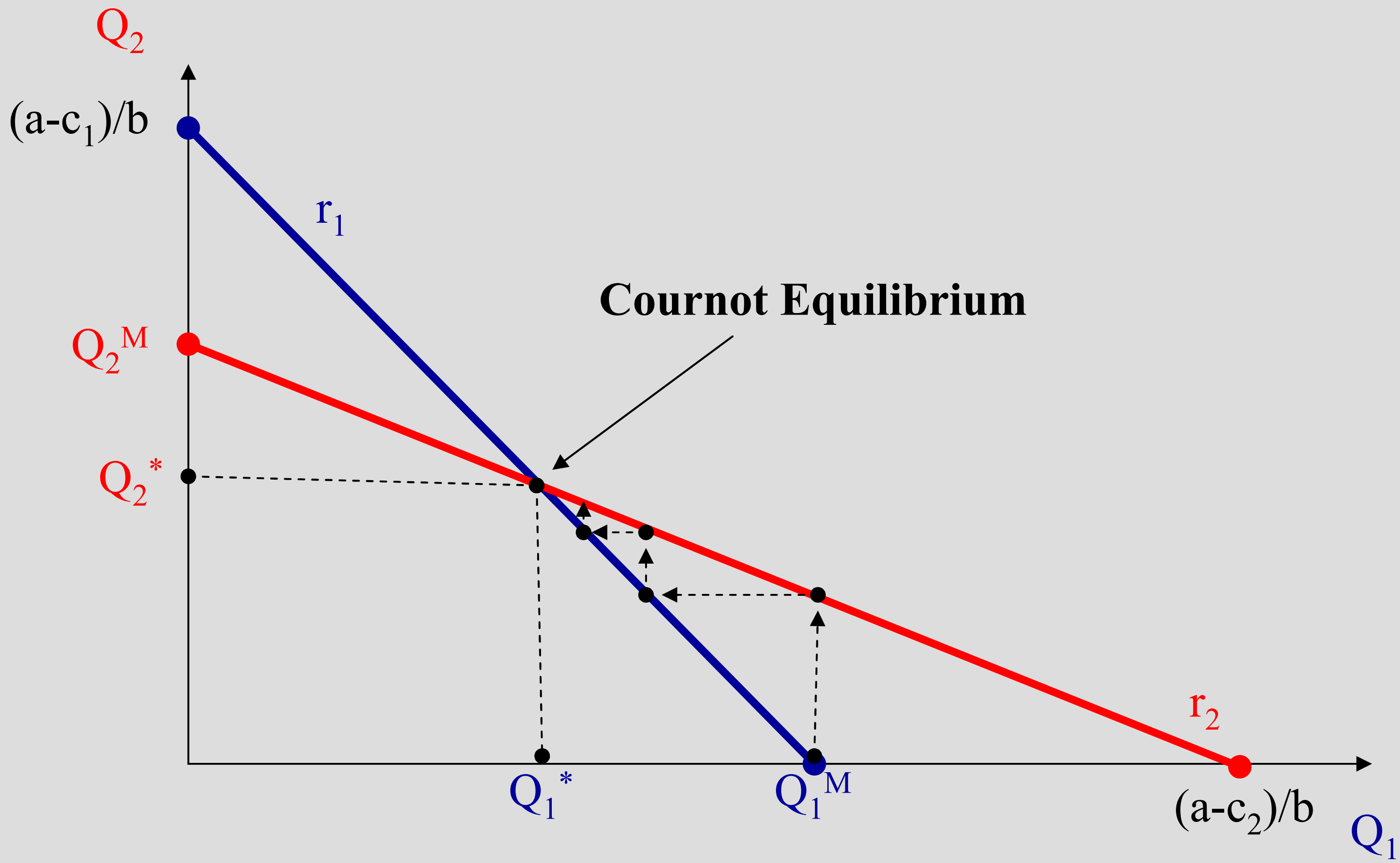
Graph of Firm 1's Best-Response Function



Cournot Equilibrium

- Situation where each firm produces the output that maximizes its profits, given the the output of rival firms.
- No firm can gain by unilaterally changing its own output to improve its profit.
    - A point where the two firm's best-response functions intersect.

Graph of Cournot Equilibrium

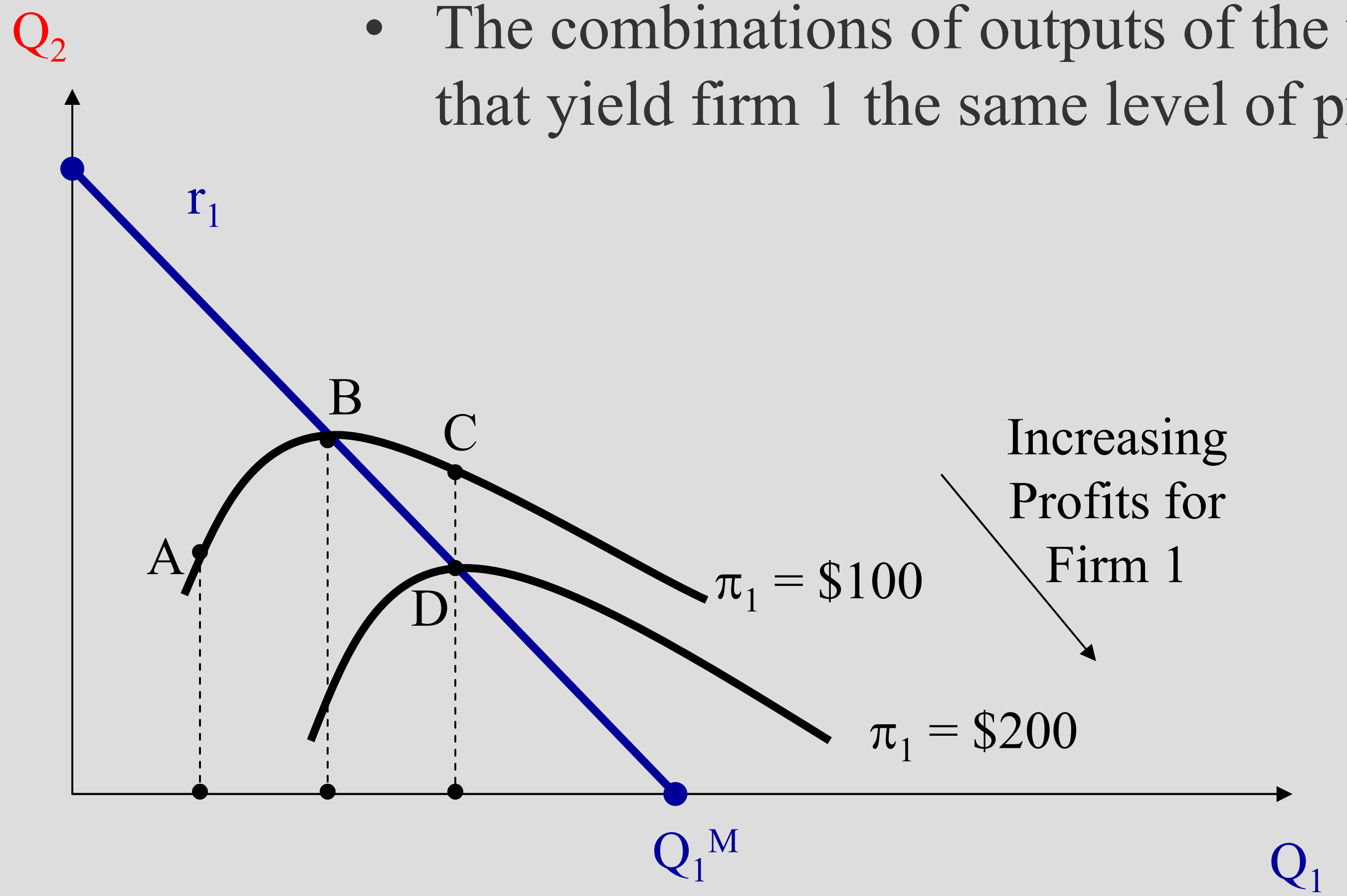


Summary of Cournot Equilibrium

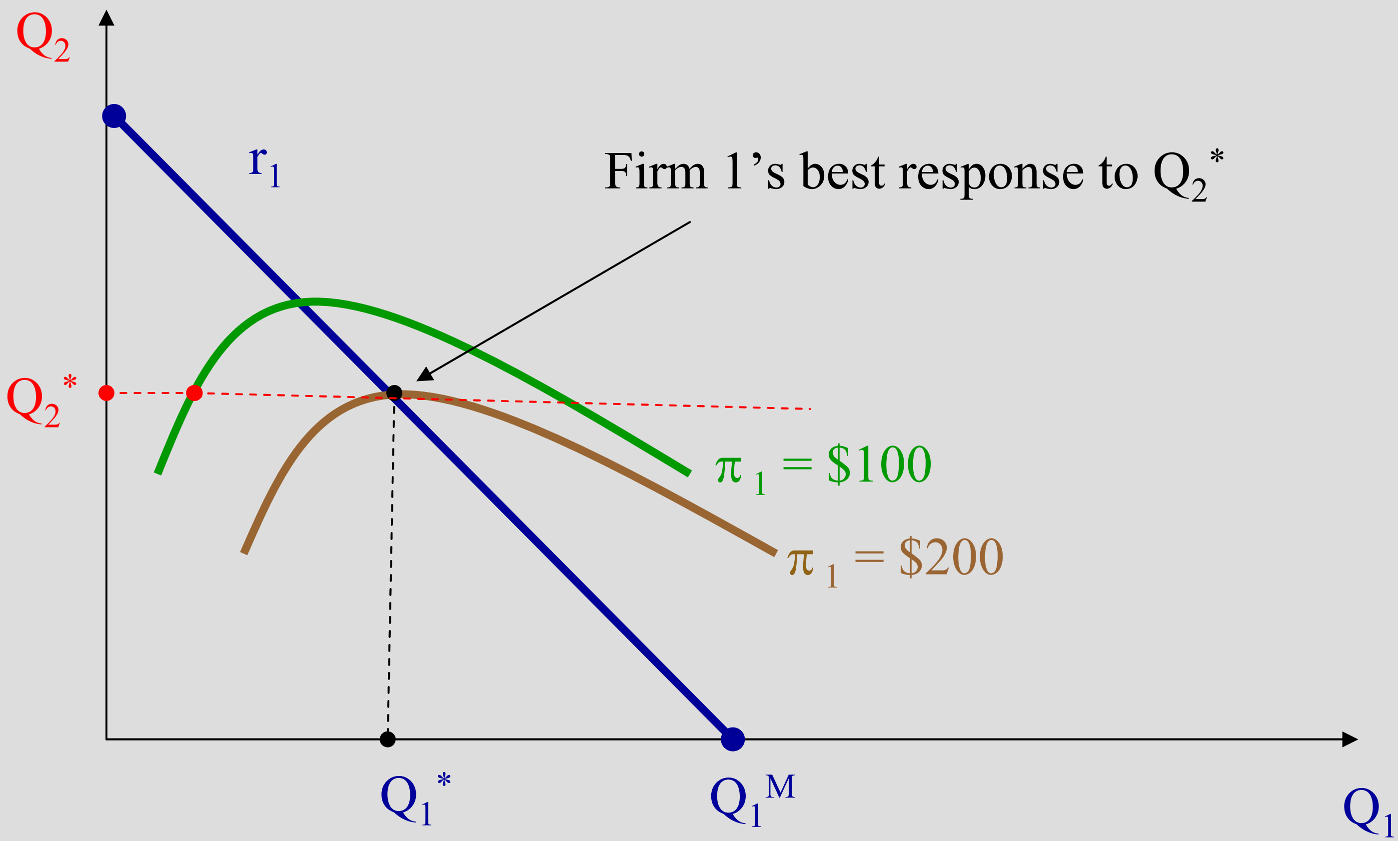
- The output Q_1^* maximizes firm 1's profits, given that firm 2 produces Q_2^*.
- The output Q_2^* maximizes firm 2's profits, given that firm 1 produces Q_1^*.
- Neither firm has an incentive to change its output, given the output of the rival.
- Beliefs are consistent:
  - In equilibrium, each firm "thinks" rivals will stick to their current output – and they do!

Firm 1's Isoprofit Curve

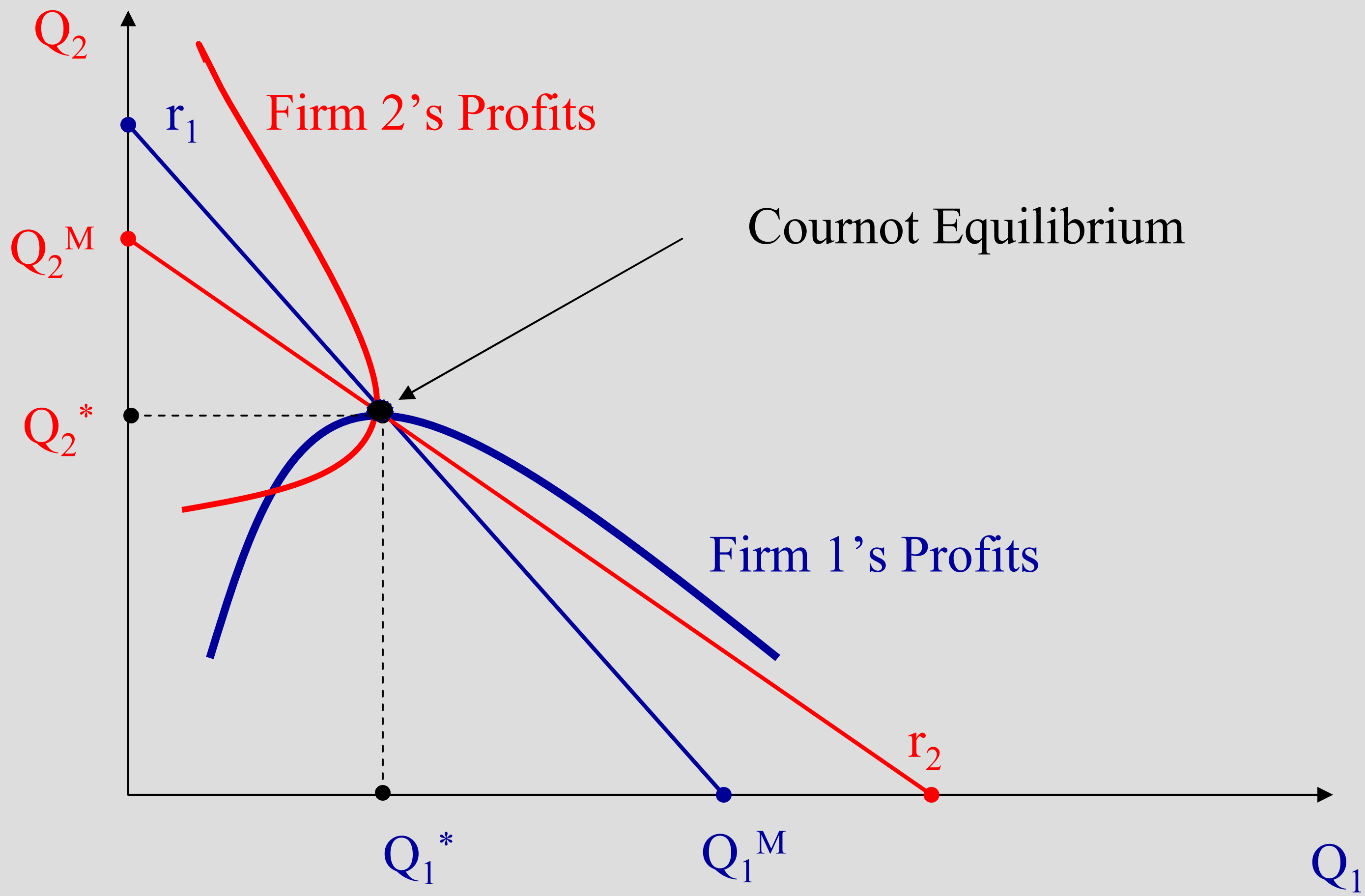
- The combinations of outputs of the two firms that yield firm 1 the same level of profit



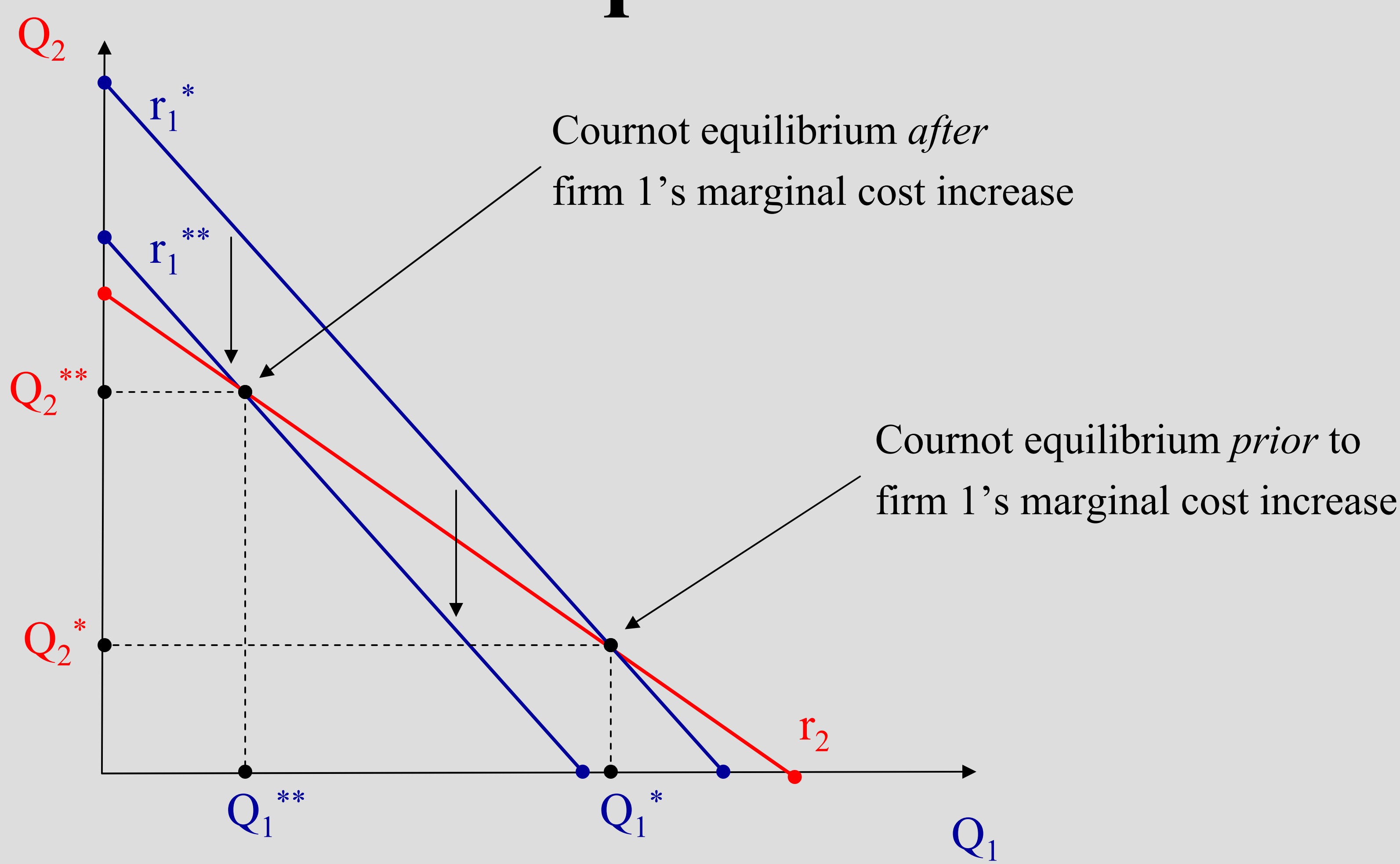
Another Look at Cournot Decisions



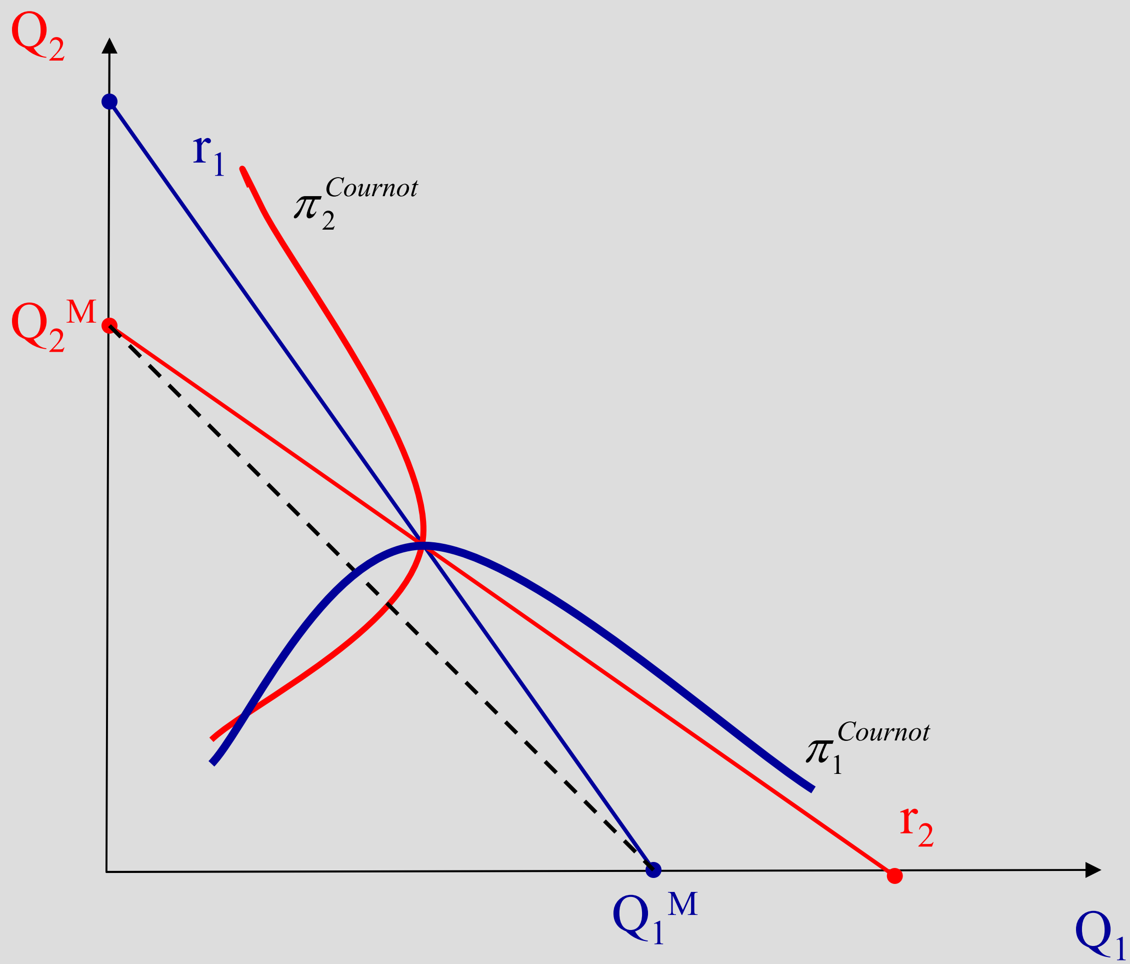
Another Look at Cournot Equilibrium



Impact of Rising Costs on the Cournot Equilibrium



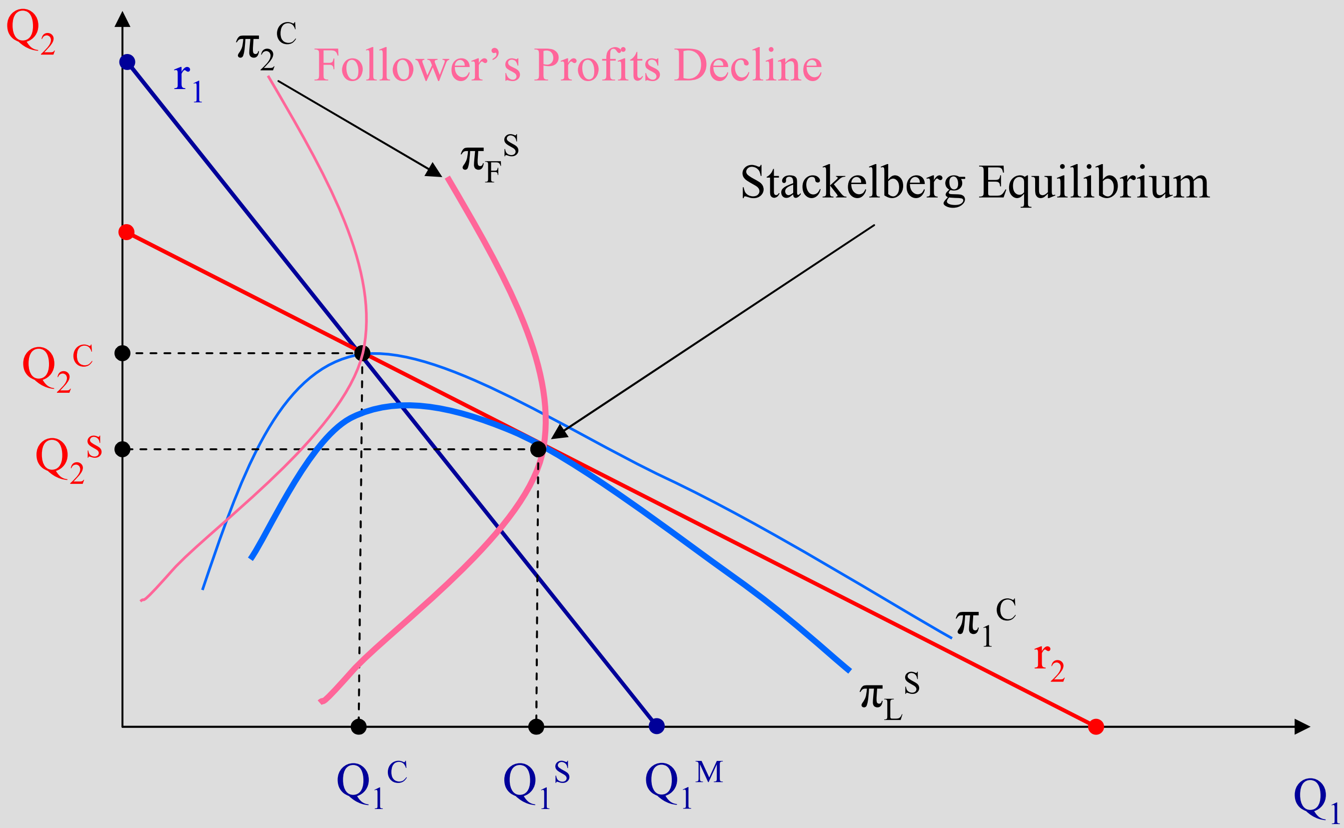
Collusion Incentives in Cournot Oligopoly



Stackelberg Model

- Firms produce differentiated or homogeneous products.
- Barriers to entry.
- Firm one is the leader.
  - The leader commits to an output before all other firms.
- Remaining firms are followers.
  - They choose their outputs so as to maximize profits, given the leader's output.

Stackelberg Equilibrium



Stackelberg Summary

- Stackelberg model illustrates how commitment can enhance profits in strategic environments.
- Leader produces *more* than the Cournot equilibrium output.
  - Larger market share, higher profits.
  - First-mover advantage.
- Follower produces *less* than the Cournot equilibrium output.
  - Smaller market share, lower profits.

Bertrand Model

- Few firms that sell to many consumers.
- Firms produce identical products at constant marginal cost.
- Each firm independently sets its price in order to maximize profits.
- Barriers to entry.
- Consumers enjoy
  - Perfect information.
  - Zero transaction costs.

Bertrand Equilibrium

- Firms set $P_1 = P_2 = MC$! Why?
- Suppose $MC < P_1 < P_2$.
- Firm 1 earns (P_1 - MC) on each unit sold, while firm 2 earns nothing.
- Firm 2 has an incentive to slightly undercut firm 1's price to capture the entire market.
- Firm 1 then has an incentive to undercut firm 2's price. This undercutting continues...
- Equilibrium: Each firm charges $P_1 = P_2 = MC$.

Contestable Markets

- Key Assumptions
  - Producers have access to same technology.
  - Consumers respond quickly to price changes.
  - Existing firms cannot respond quickly to entry by lowering price.
  - Absence of sunk costs.
- Key Implications
  - Threat of entry disciplines firms already in the market.
  - Incumbents have no market power, even if there is only a single incumbent (a monopolist).

Conclusion

- Different oligopoly scenarios give rise to different optimal strategies and different outcomes.
- Your optimal price and output depends on …
  - Beliefs about the reactions of rivals.
  - Your choice variable (P or Q) and the nature of the product market (differentiated or homogeneous products).
  - Your ability to credibly commit prior to your rivals.