Introductory Microeconomics
ECO/1A1Y

Imperfect Competition

Outline

- Topics
  - Imperfect competition and space
    - Spatial Patterns
  - Monopolistic Competition
    - Product Differentiation
    - The short run: differentiation and brands
    - The long run: excess capacity
  - Models of Competition with homogenous products
    - Bertrand
    - Courtnot
    - Stackelbergh

Imperfect Competition

- PC & Monopoly are useful benchmarks.

- But, in more than half of the 800 major UK manufacturing product categories, 70% of market is shared by 5 largest firms in the market.

- Real world markets are imperfectly competitive

- Imperfectly competitive (IC) firms cannot sell as much as want at going market price; they face a downward sloping demand curve.

Imperfect Competition

- Not one, not a large number of firms but
  - a few, not too many

- When there are not too many firms in the industry, we see a mixed bag of markets

  - Spatial competition (Where to locate your store?)
  - Monopolistic competition (lot of variety, many brands)
  - Duopoly: two firms selling the same things
  - Oligopoly: few firms selling similar products

Imperfect Competition
Different Types Of Competition

- Price and Quantity (same identical product)
- Quality (advertising, location, product variety)

- Competition is always competitive, but some forms of competition are more competitive than others

- Some competition is costlier than others (for firms)

  - Price competition (with no quality difference) is more intense and costlier
  - Quantity competition is softer
 - Quality competition is even less damaging

Imperfect Competition
Price Competition

- Supermarkets compete in terms of price of low-value items
  - Tesco value vs Sainsbury basics
  - Ryan Air versus Easy jet

- Price competition is not good for firms: no (supernormal) profits (perfect competition) when the good is identical

- Outcome: Firms try to avoid price competition

- How? Differentiation
  - Different markets: Airlines do not fly to the same airports
  - Different products: Brands and/or location
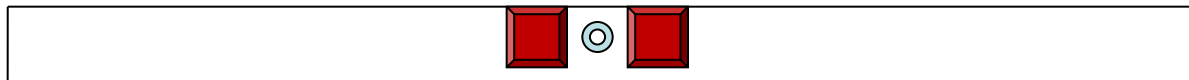
Spatial Competition
The Optimal Location?

City Centre

Store 1

Store 2

- In an **ordinary city**:

Store 1   City Centre   Store 2
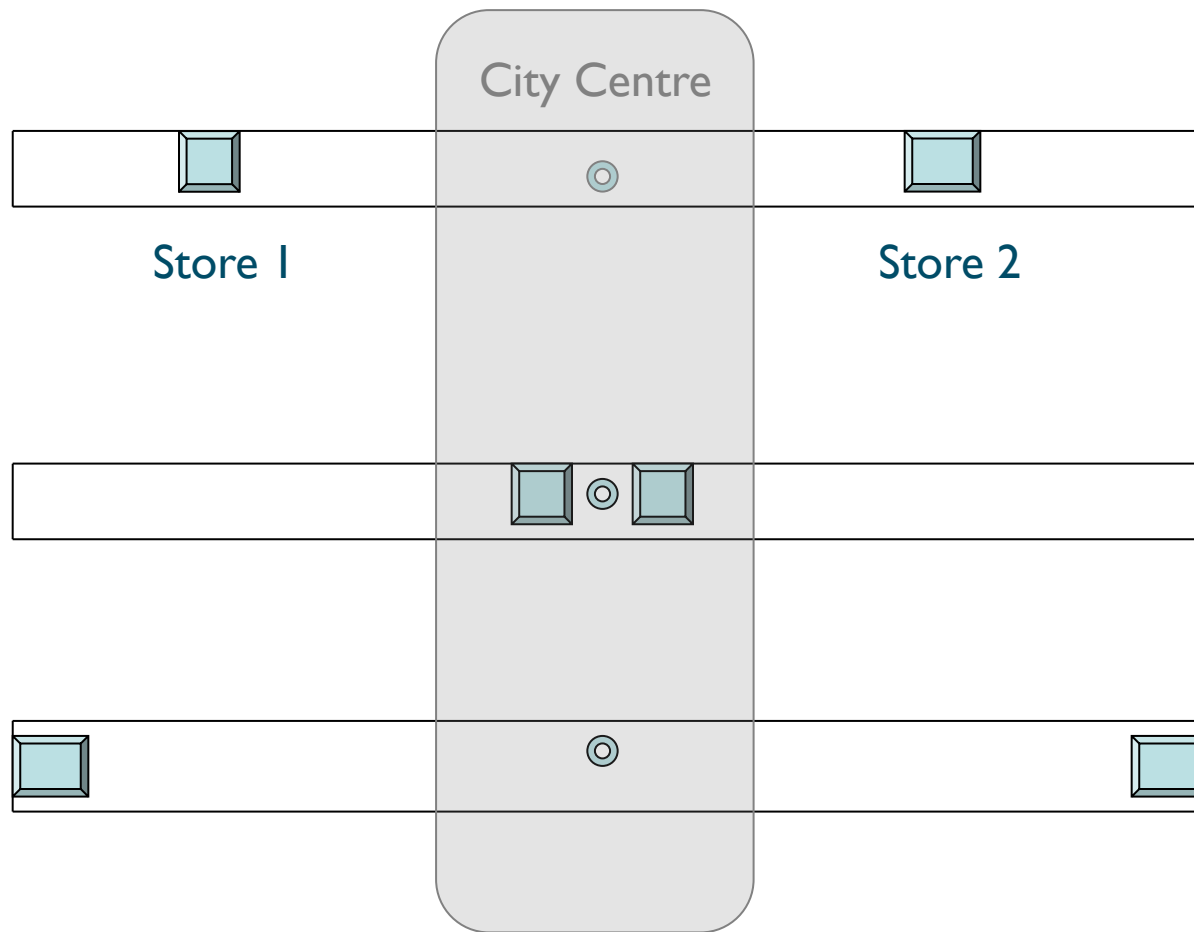
- In a **tourist place**:

- Ordinarily firms locate far apart to avoid competition

- In a tourist place, close to each other to benefit from concentrated demand, As tourists visit the same places (competition is better than nothing)
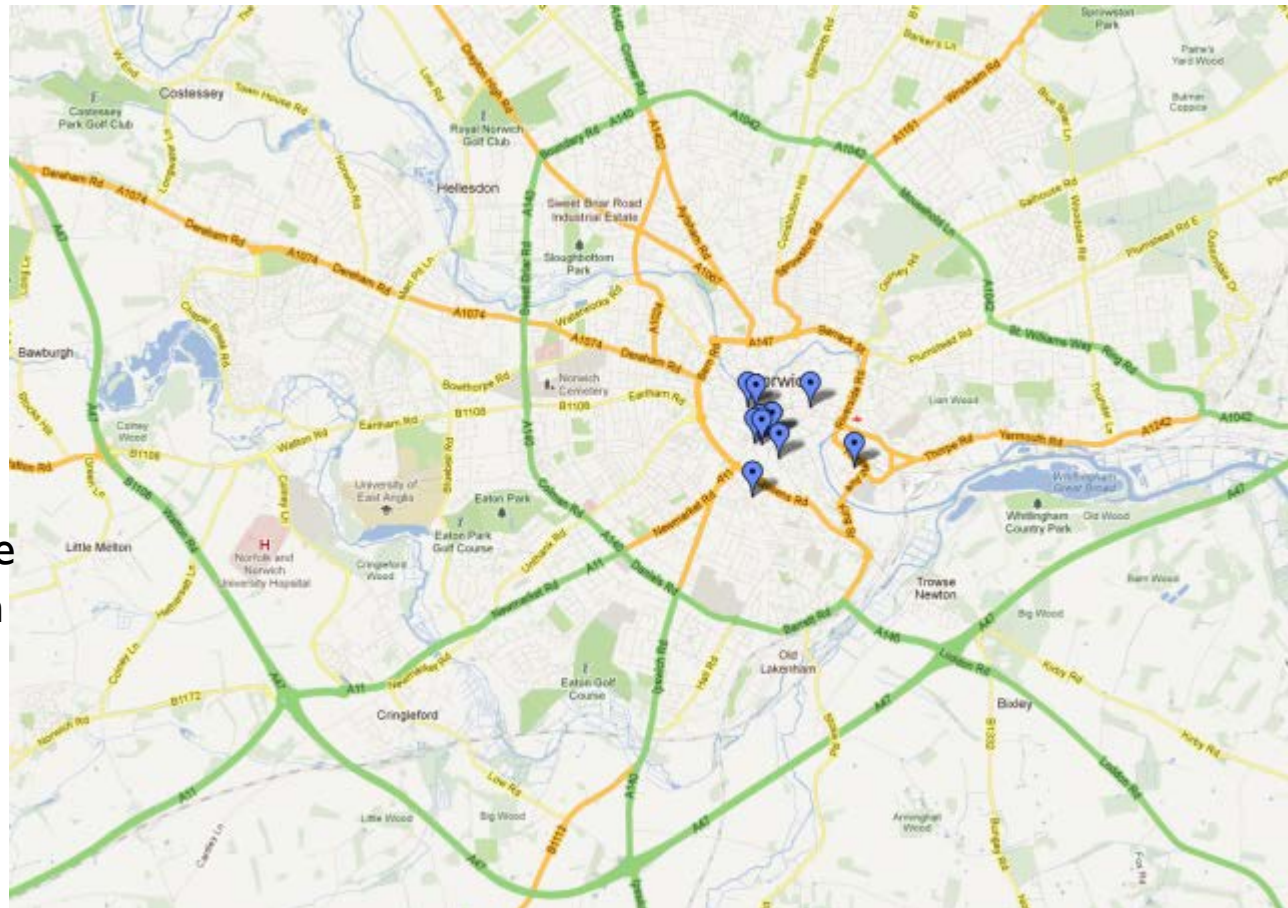
Spatial Competition
Some Patterns

- Circular Norwich Superstore location?

    - Firms would try to locate with some gaps in between
    - Do They?

Spatial Competition
Some Patterns

- Location strategy of supermarkets

  - Avoid poaching into each other's geographic market

- But, the **city center** is a different game

  - Since a lot of out-of-town shoppers come to the city centre, the market is not fixed in the geographic sense

  - The tourist market argument should apply here

Spatial Competition
The Additional Benefits Of Clustering

- Why is Hollywood so successful in making movies?

- Why do stock brokers are concentrated in City or Wall Street?

- A coordination game solved by agglomeration economies

Monopolistic Competition
Product Differentiation

- Some markets are characterised by product differentiation:
  - Ethnic restaurants
  - Cosmetics
  - Health care products
  - Breakfast cereals

- By developing brand loyalty small monopolies can be created around the brand
  - Competition across brands will still be there

- These markets are monopolistically competitive
  - Number of firms is more than few, but not too many

Monopolistic Competition
Product Differentiation

- Product differentiation is vital

- Brand name matters: 2011 brand values (Interbrand)
    - 71,861 $m Coca Cola
    - 69,905 $m IBM
    - 59,087 $m Microsoft

    - Washing market: differentiate your product (or die...)

Monopolistic Competition Product Differentiation

- The logic of brands

- Why do musicians dress outrageously?

- Why do painters appear to be eccentric?

    - They themselves are brands

    - By looking different they establish their brand identity: a monopoly

Monopolistic Competition Chamberlin Model

- A *differentiated product* is one that buyers consider to be a good, but not perfect, substitute for another

- **Market Characteristics**
  - Each firm sells a differentiated product.
  - There is a large number of firms.
  - The industry has enough firms that when one cuts its prices, every other firm loses only a small quantity of its sales.
  - The industry has free entry.

Monopolistic Competition Chamberlin Model

- Two implications:
    - Because the products are viewed as close substitutes, each firm will confront a downward-sloping demand schedule.
    - Each firm will act as if its own price and quantity decisions have no effect on the behaviour of other firms in the industry
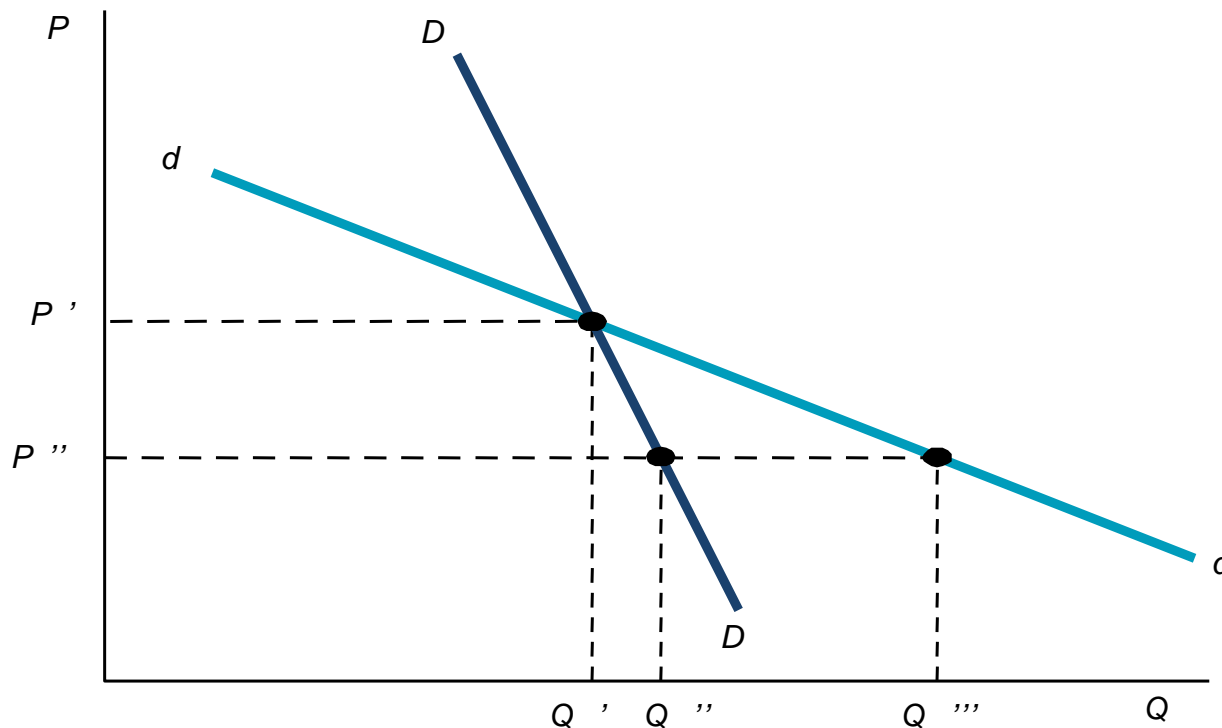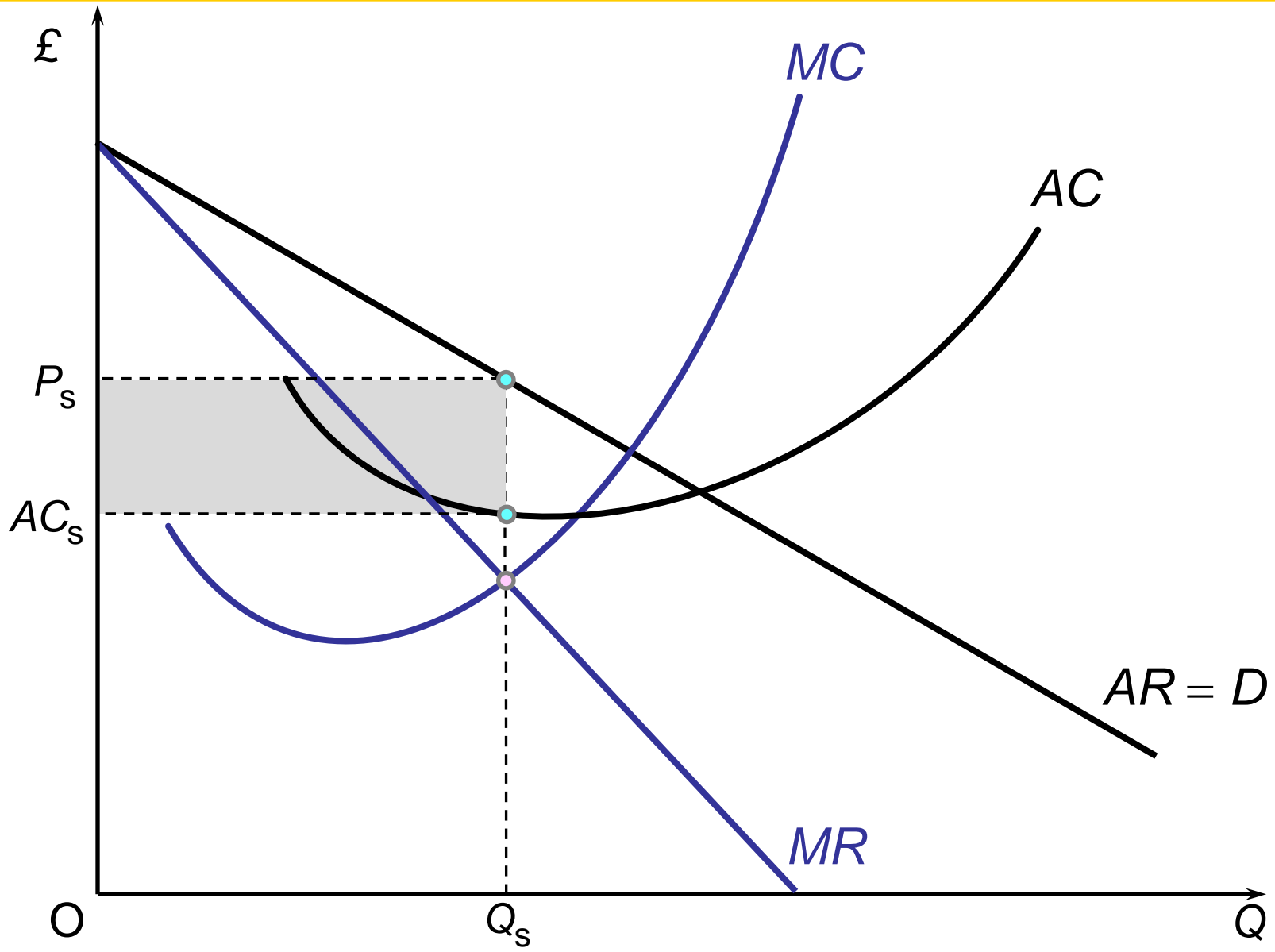
Monopolistic Competition
The Short Run

- Monopoly power can be created due to brand loyalty

- In the short run new brands cannot be introduced, so (brand) competition is limited

- This allows existing brands to generate (supernormal) profit, like a (normal) monopoly

Monopolistic Competition
The Short Run

- How do firms choose the optimal quantity and price of a given brand/product (in the SR)?

- By the MR=MC rule just like a monopolist (or any other rational agent)

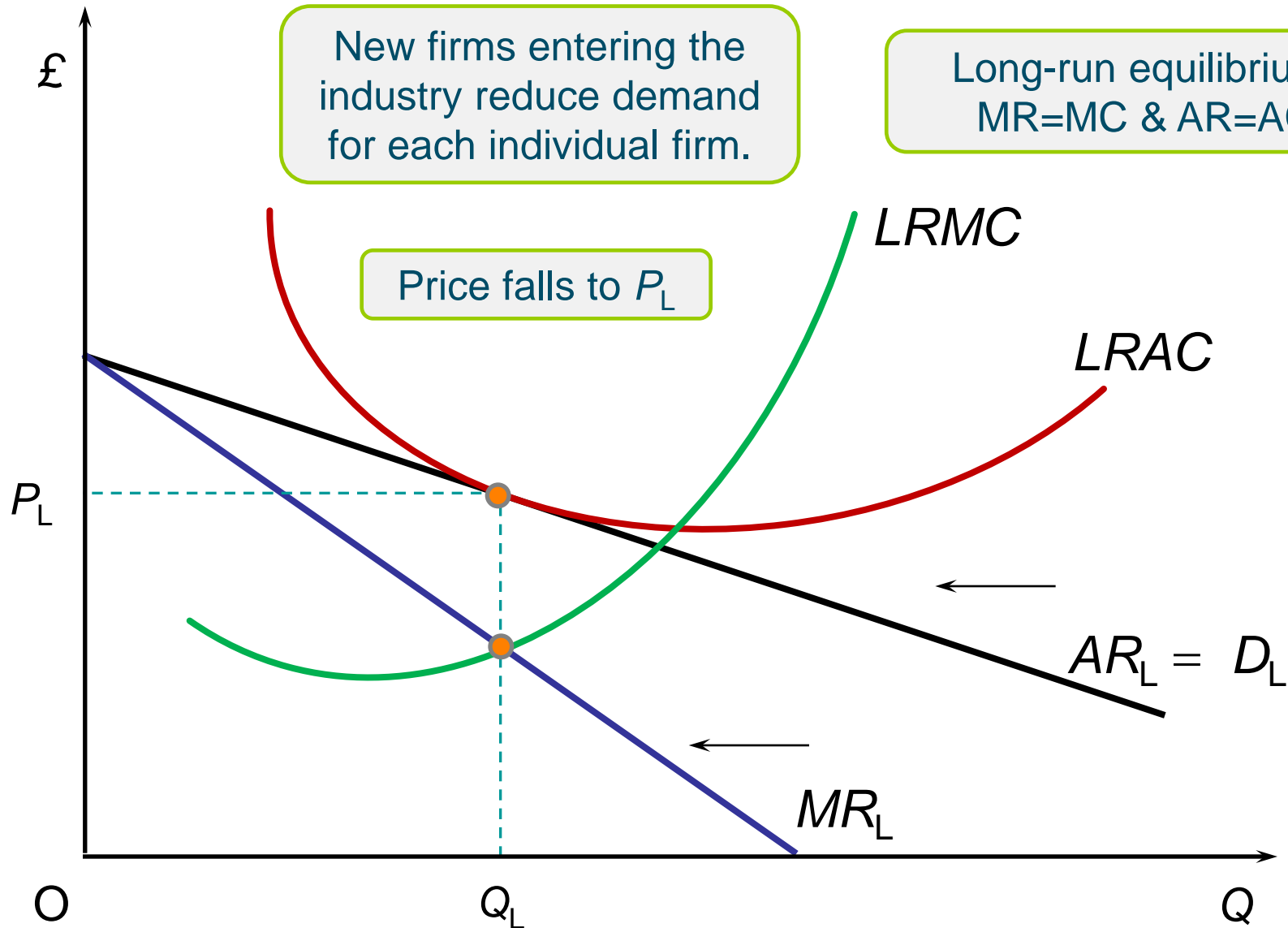- This gives them positive profit: Price > MC and Price > AC

Monopolistic Competition
The Long Run

- In the long run competition kicks in, in the form of new entry, new brands

- As new brands are introduced, existing brands face a contraction in their demand
  - New entries shift the demand curve for existing firms to the left
  - The process of introducing new brand and greater competition will continue until profit disappears
  - All firms end up with zero profit (or normal profit)

- Long-run equilibrium occurs when new firms see no further incentive to enter

Monopolistic Competition
The Long Run

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New firms entering the industry reduce demand for each individual firm.

Long-run equilibrium:
MR=MC & AR=AC

LRMC

Price falls to P_L

LRAC

P_L

$AR_L = D_L$
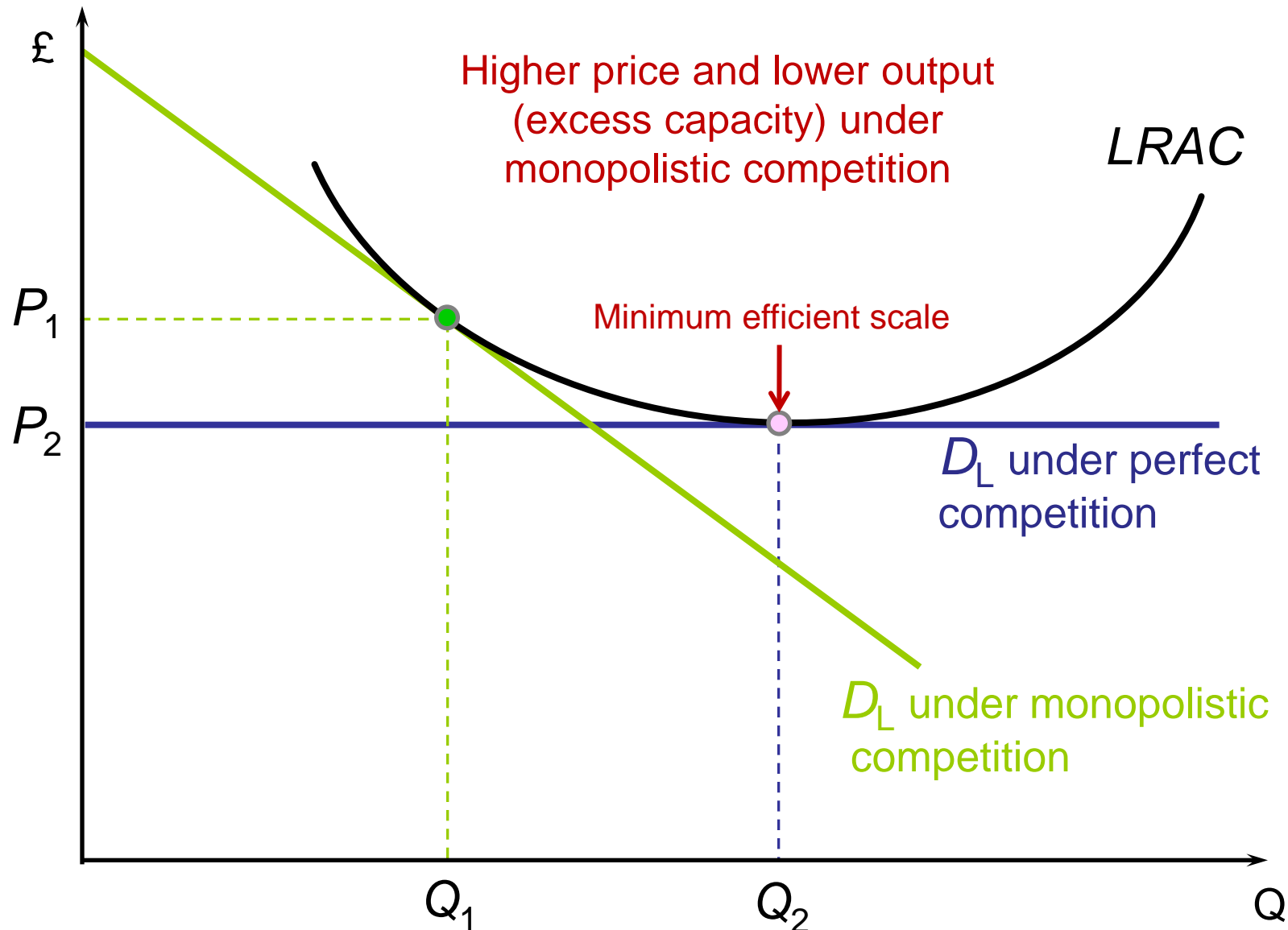
MR_L

O Q_L Q

Monopolistic Competition
The Long Run

- In the long run each firm still decides by the MR=MC rule

- But because of demand contraction (competition) MR and AR both shift leftward

- New equilibrium will have lower P and Q

- Profit disappears for all (good!)

- But, price=AC>MC (*good?*)

Monopolistic Competition Compared to Perfect Competition

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Higher price and lower output (excess capacity) under monopolistic competition

LRAC

P_1

Minimum efficient scale

P_2

D_L under perfect competition

D_L under monopolistic competition

Q_1 Q_2 Q

Monopolistic Competition Excess Capacity and Product Variety

- What about welfare?
  - Despite zero profit *monopolistic* competition is not as good as *perfect* competition
- Why? long run Q < Minimum efficient scale (or MES)
  - Q is below the social optimum: **excess capacity**
  - A firm has **excess capacity** if it can reduce its average cost by raising its output.
- Average costs could be decreased by reducing product variety
  - This is essentially 'wastage'
  - or a price for product variety price that people pay for product diversity and choice

Monopolistic Competition
Bad news for firms…

- … long run profit zero

- …unless firms fight back brand competition

- How?
  - Creating their own competition
  - Since in the LR brand competition is inevitable, existing firms will have more than one brand
  - They pre-empt potential competition (entrants)

- Why?
  - Because profit increases
  - Enough variety but less brand competition

- One example: Breakfast cereal market
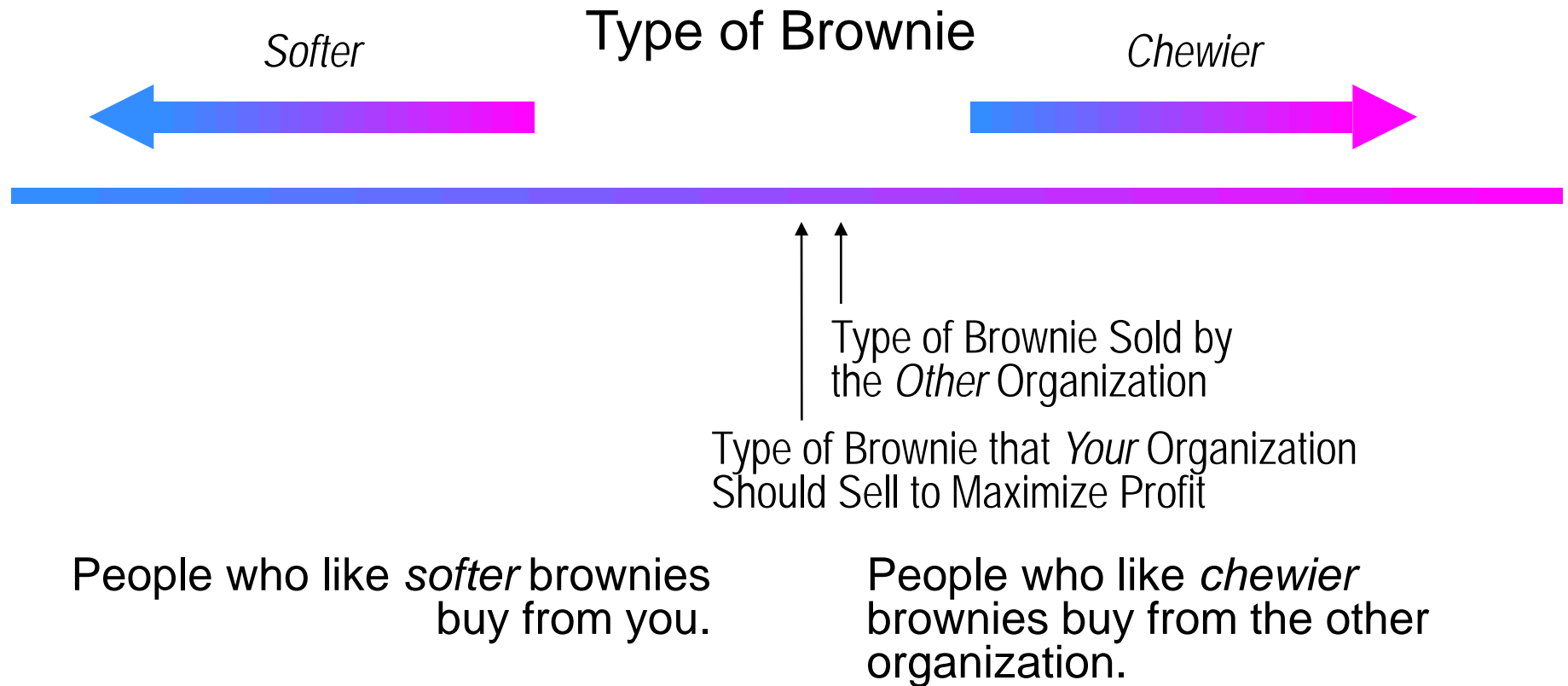
Nonprice Competition

- Firms in monopolistic competition engage in nonprice competition.

    - Provide better-quality products.

    - Product characteristics are designed to match the preferences of specific groups of consumers.

    - One example -- Breakfast cereal market (Kellogg's has 97 verities)

    - May compete on **location** (spatial location or location in product attributes).

Profit-Maximizing Product Differentiation

Type of Brownie

Softer

Chewier

Type of Brownie Sold by
the *Other* Organization

Type of Brownie that *Your* Organization
Should Sell to Maximize Profit

People who like *softer* brownies
buy from you.

People who like *chewier*
brownies buy from the other
organization.

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Monopolistic Competition Summary

- Assumptions of monopolistic competition
  - many or several firms
  - free entry
  - differentiated product

- Equilibrium of the firm
  - short run: MR = MC
  - long run: MR = MC; AR = AC (p>MC and profits = 0)
  - under-utilisation of capacity in long run

Models of Price and Quantity Competition

Strategic interaction

Competition in (real) markets

- Competition occurs at different levels

    - Level 1: developing a new variety (or quality), a new colour soap for example – This is R&D stage

    - Level 2: marketing the new variety, persuading the consumers to try it – Advertising stage

    - Level 3: Once a particular product variety is selected, the firm needs to decide on the price and quantity

Competition in (real) markets

- Short-run competition is only about level 3 competition (ignoring level 1 and level 2 competitions)

    - The variety is already introduced to the consumers
    - The variety suits some consumers more than others
    - The product will enjoy a small monopoly around these consumers
    - Other consumers will be less loyal to this variety
    - They will be more sensitive to price charged by other firms

- Long-run competition involves all three levels

Oligopoly/Duopoly

- An oligopoly is a market structure characterized by the following conditions
  - there are few firms
  - producing either homogenous or differentiated products
  - entry is difficult

- Duopoly -- strictly, an oligopoly with only two producers
  - More generally can be when there only two dominant firms with market shares
    - Dish Network and DirecTV in the U.S. satellite provider market
    - Kleenex and Puffs in facial tissues
    - Marvel Comics and DC Comics in the comic books market

Oligopoly/Duopoly

- Oligopolies are made up of a small number of firms in an industry
  - In any decision a firm makes, it must take into account the expected reaction of other firms
  - Oligopolistic firms are ***mutually interdependent***
  - Firms may engage in strategic decision making where each firm takes explicit account of a rival's expected response to a decision it is making

- Critical and common characteristics
  - Firms are price setters
  - Each firm's decisions influence its rivals'decisions
  - Each firm is aware of this

Oligopoly/Duopoly Interdependence

- **Interdependence --** a key characteristic of oligopolies is that each firm can affect the market, making each firm's choices dependent on the choices of the other firms – thus they are interdependent

  - The importance of interdependence is that it leads to strategic behaviour.

  - Strategic behaviour is the behaviour that occurs when what is best for A depends upon what B does, and what is best for B depends upon what A does.

  - Oligopolistic behaviour includes both ruthless competition and cooperation

Bertrand Competition
Price competition

- **Bertrand model:** oligopoly model in which each firm assumes that rivals will continue charging their current prices

- Price competition
  - By undercutting the other firm's price one firm can generally get (or steal) the whole market
  - Each firm, aware of this possibility, can charge the lowest price
  - The lowest price is no lower than the marginal cost

Bertrand Competition 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 $P_1 = P_2 = MC$

Bertrand Competition Example

- Market demand given: $p = 66 - Q = 66 - (Q_1 + Q_2)$
- Each firm's total cost of production: $C_1 = 6Q_1$ and $C_2 = 6Q_2$

  - MC=AC= 6 for both firms
  - $p^* = MC = 6$
  - $Q^* = 66 - 6 = 60 \rightarrow Q_1^* = Q_2^* = 30$
  - $\Pi_1 = \Pi_2 = (6 - 6) * 30 = 0$

Bertrand Competition Prediction …

- There is something about price competition…
  - Prediction of price competition: zero profit (as under perfect competition in the long run)

- Not that likely in duopolistic markets.
  - Firms avoid head-on price competition by differentiating their products (recall supermarkets' locations, brands)
  - Firms very often engage in output competition (softer competition) rather than price competition (e.g. petrol pumps, more pumps attract more cars)

Cournot Model

- ***Cournot model:*** oligopoly model in which each firm assumes that rivals will continue producing their current output levels.
    - Main assumption - each duopolist treats the other's quantity as a fixed number; one that will not respond to its own production decisions

- Each firm's output choice is based on two considerations:
    - Is my (output) choice profitable, given my rival's (actual or anticipated) choice?
        - Responding to my rival's strategy
    - Will my choice (output) impact my rival's (output) choices?
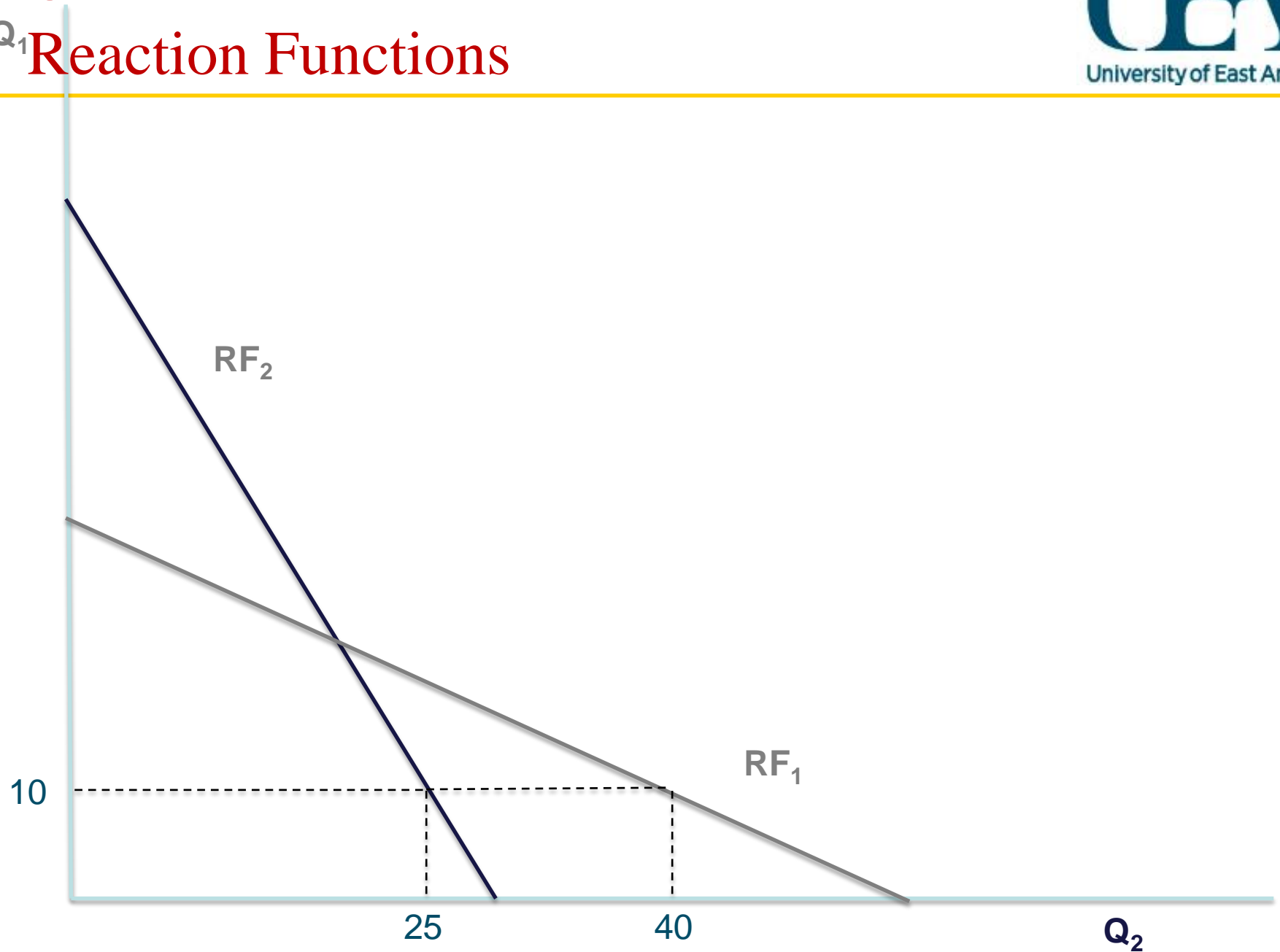   - Anticipating the impact of my strategy on my rival

Cournot Model
Reaction Functions

- *Reaction function:* a curve that tells the profit-maximizing level of output for one oligopolist for each amount supplied by another

  - My reaction function describes how I react or respond to my rival's output

  - Reaction function of my rival describes the impact of my actions on my rival's output

  - Thinking strategically:
    - If a rival increases its output, I should reduce my own (to avoid a price crash from oversupply)
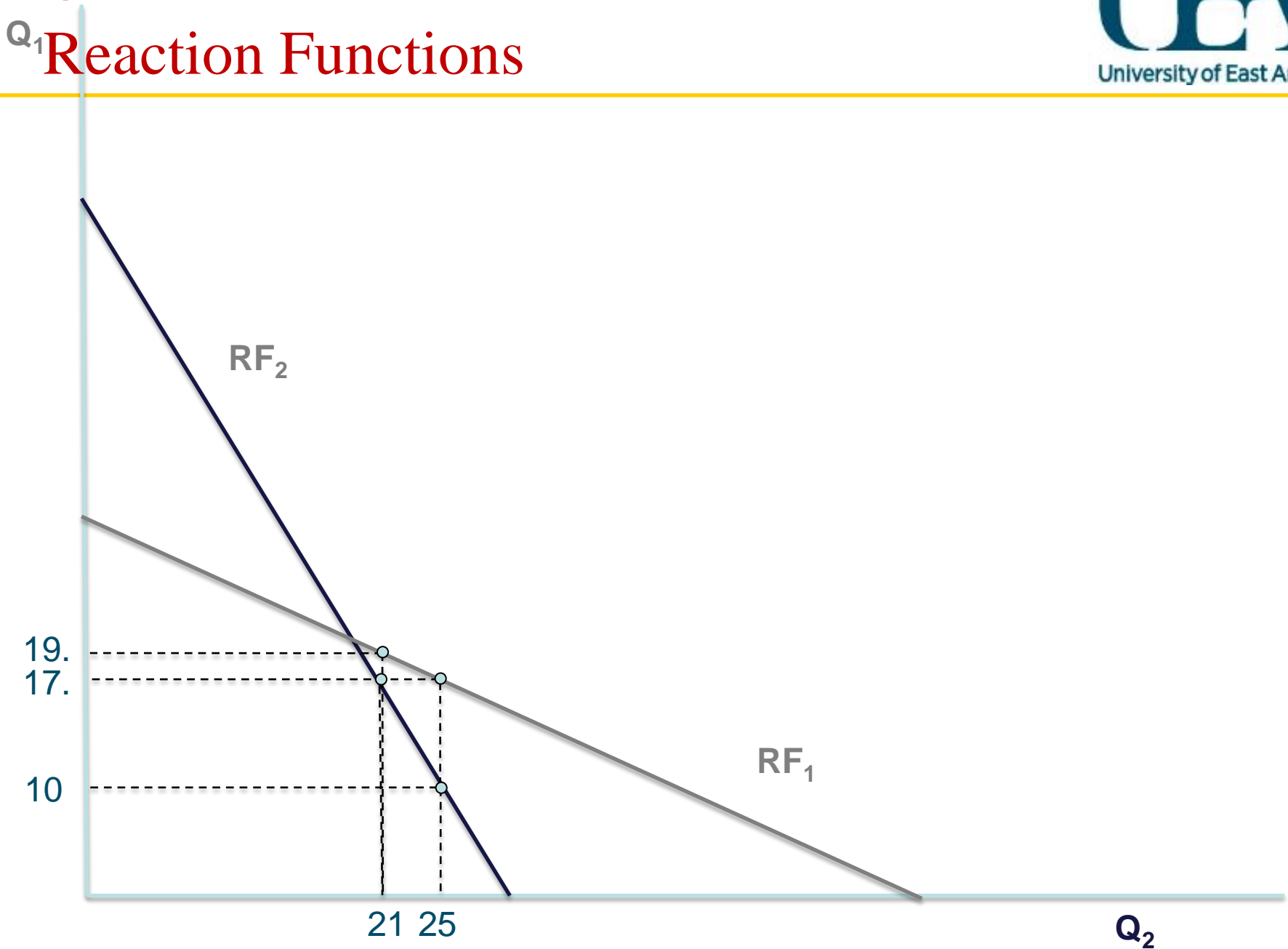   - To force my rival to cut back production I must increase my output

Reaction Functions

Q_1
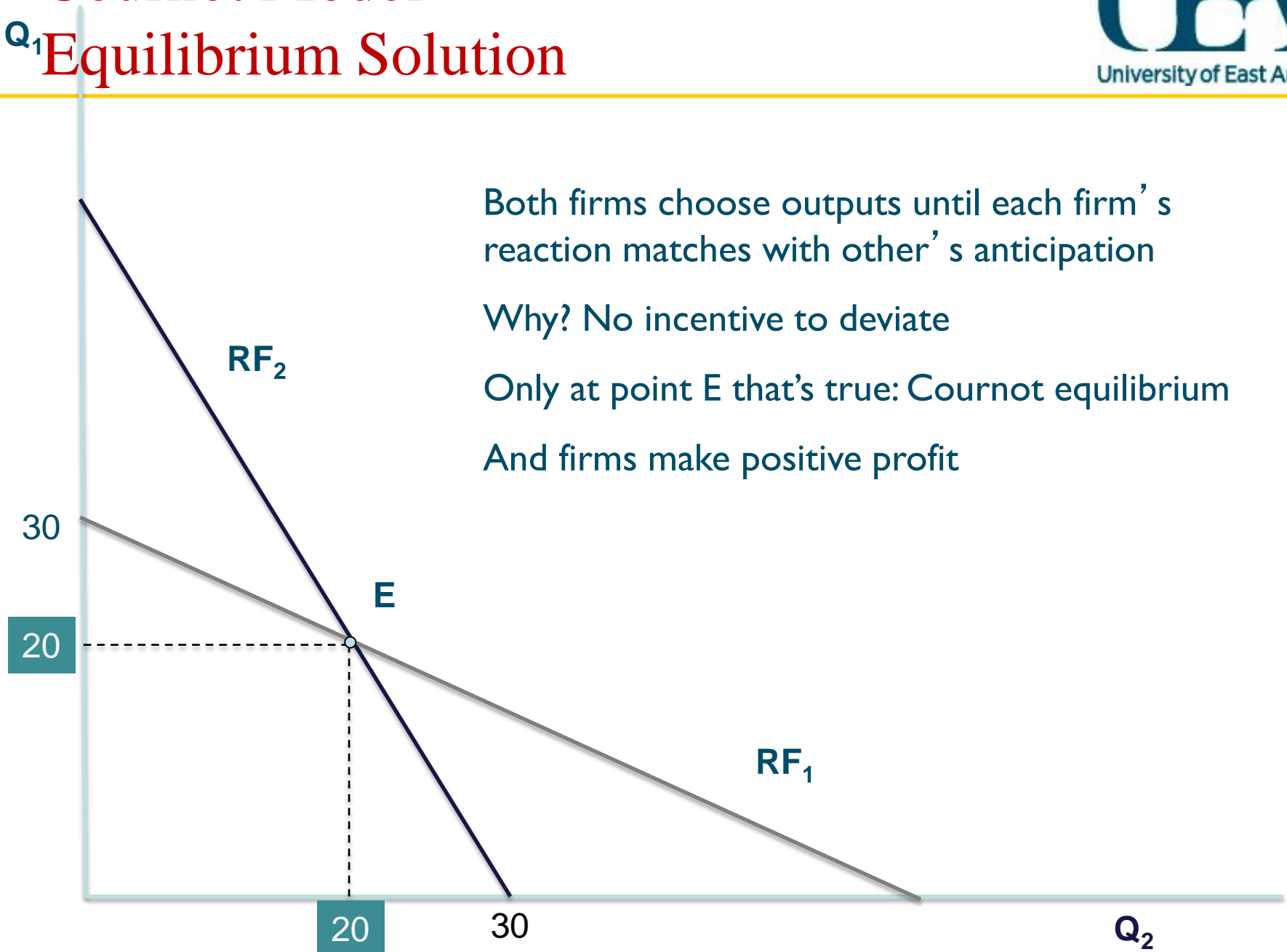
RF_2

RF_1

10

25

40

Q_2

Cournot Model Equilibrium Solution

Q_1

Both firms choose outputs until each firm's reaction matches with other's anticipation

Why? No incentive to deviate

Only at point E that's true: Cournot equilibrium

And firms make positive profit

RF_2

RF_1

E

30

20

20

30

Q_2

Cournot Model Example
An Example Of Cournot Duopoly

- Market demand given: $p = 66 - (Q_1 + Q_2)$

- Each firm's total cost of production: $C_1 = 6Q_1$ and $C_2 = 6Q_2$

- How will each firm decide on its production when they do not know what the other is doing?

- Even if they do not know, they can anticipate each other's decision by simply putting itself in other's shoes.

Cournot Model Example
Firm 1's strategic decision

- Firm 1 thinks about Firm 2

- For every decision of Firm 2, Firm 1 needs to figure out what is best

- But, wait a second, Firm 1 (and 2) is rationally trying to maximize its profit

- Rational behaviour? MC=MR

- $C_1 = 6Q_1$ and $C_2 = 6Q_2$ … implies … MC=AC= 6 for both firms

- What about MR?

Cournot Model Example Derivation of MR

- We derive MR for each firm:

- MR for firm 1 is given by $d(TR_1)/dQ_1$.

  - $TR_1 = PQ_1 = \big(66 - (Q_1 + Q_2)\big)Q_1$
  - $TR_1 = 66Q_1 - Q_1^2 - Q_1 Q_2$
  - $MR_1 = \dfrac{d(TR_1)}{dQ_1} = 66 - 2Q_1 - Q_2$

- Likewise MR for firm 2 is given by $d(TR_2)/dQ_2$
  - $MR_2 = 66 - 2Q_2 - Q_1$

Cournot Model Example
Firm 1's reaction function

- For every decision of Firm 2, Firm 1 needs to figure out what is best
    - Denote every decision as just Q_2

- Then, we apply the $MR_1 = MC_2$ rule
    - $66 - Q_2 - 2Q_1 = 6$

- So, we find the rational strategic rule: Q_1 in terms of Q_2
    - **$Q_1 = [60 - Q_2]/2.$**

- This equation tells you how firm 1 would choose its output if firm 2 has chosen a particular level of output: Firm 1's **reaction function**

Cournot Model Example
Firm 1's reaction function

- $Q_1 = 30 - Q_2/2$

Given Q_2	Firm 1's reaction (Q_1)
0	30
10	25
20	**20**
30	15
40	10
50	5
60	0

Cournot Model Example
Firm 2's reaction function

- $Q_2 = 30 - Q_1/2$

Given Q_1	Firm 2's reaction (Q_2)
0	30
10	25
20	**20**
30	15
40	10
50	5
60	0

Cournot Model Example
An equilibrium solution

At E, each firm's anticipation of other firm's output matches with actual output

And

their reaction matches with the other firm's anticipation as well

RF1: $Q_1 = 30 - Q_2/2$
RF2: $Q_2 = 30 - Q_1/2$

Q_1

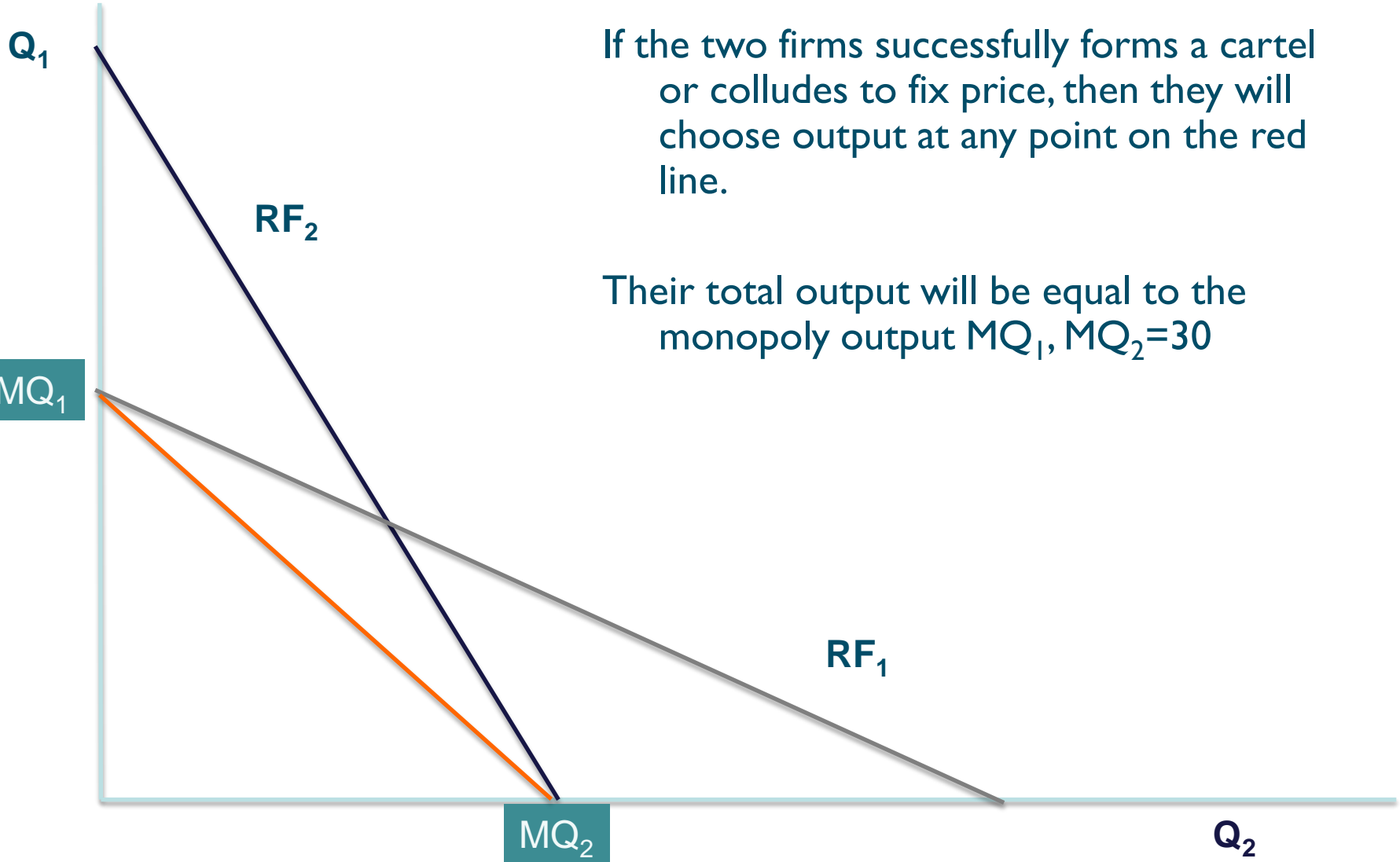RF_2

E

Q_1

RF_1

Q_2

Q_2
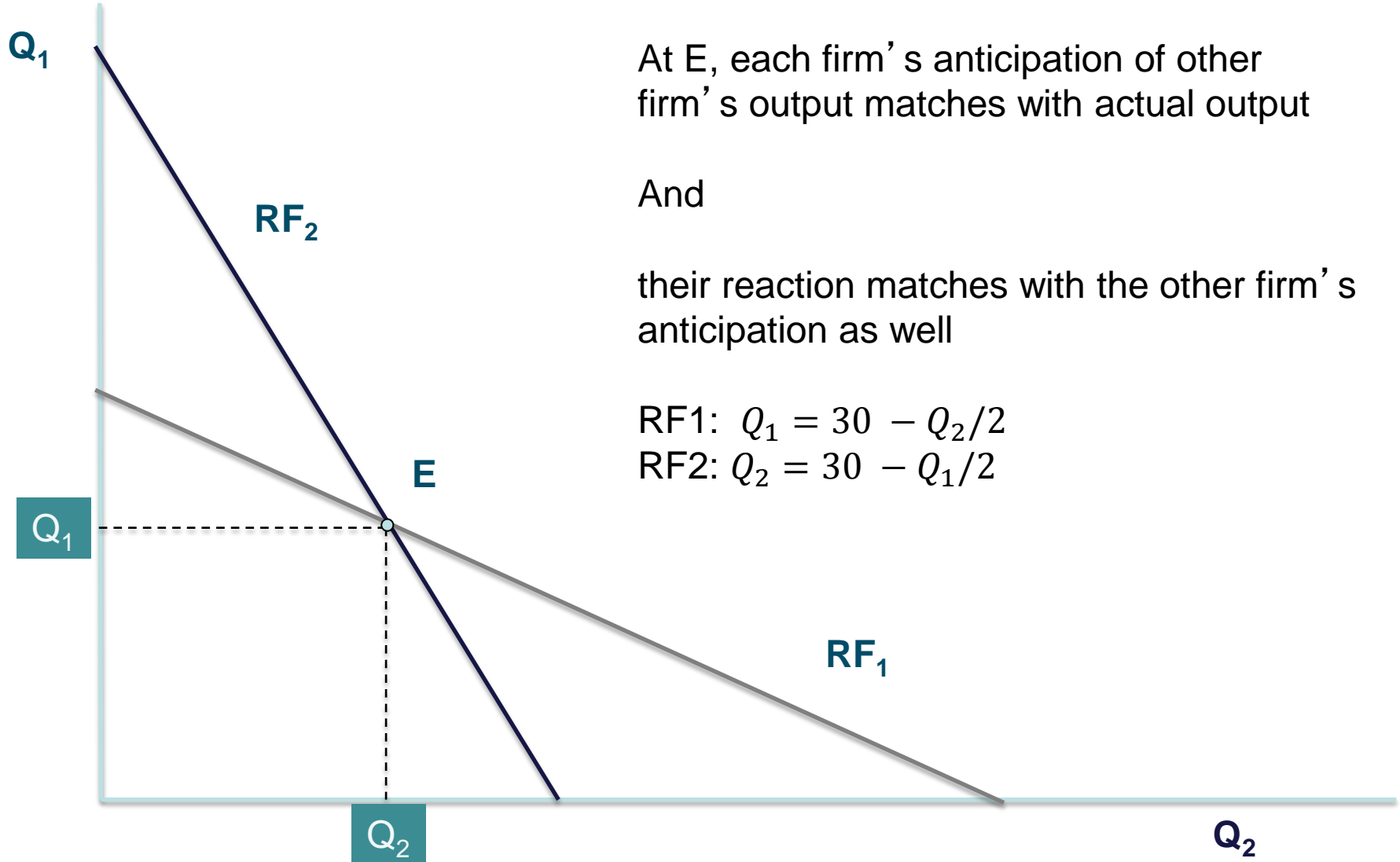
Cournot Model Example Equilibrium profit?

- $Q_1 = 30 - Q_2/2$ AND $Q_2 = 30 - Q_1/2$
- Solve for Q_1 and Q_2 (i.e., point E on the previous graph)
- At E, each firm produces 20 units of output

  - Outputs: $Q_1^* = Q_2^* = 20$ and $Q_{TOT}^* = 40$
  - Market Price: $p = 66 - (20 + 20) = 26$
  - Revenues (of each firm) = $26 \times 20 = 520$
  - Cost of production (for each firm) = $6 \times 20 = 120$
  - Profits: $\Pi_1 = \Pi_2 = 520 - 120 = 400$
  - Industry Profit: $400 + 400 = 800$

If the two firms successfully forms a cartel or colludes to fix price, then they will choose output at any point on the red line.

Their total output will be equal to the monopoly output MQ_1, MQ_2=30

Cournot Model Example
What if they collude (cartel)?

- If we had only one firm in the market - a monopoly - and if the firm had a constant MC = 6, then we know the profit maximizing firm would find the Q where MR = MC and set the Q back into the demand curve to get the price. Let's do this.

  - Market demand given: $p = 66 - (Q_1 + Q_2) = 66 - Q$
  - $MR = 66 - 2Q$
  - $MR = MC \rightarrow 66 - 2Q = 6 \rightarrow$
  - $Q^* = 30, P^* = 36$
  - Industry Profit: 900 (450 each)

  - Compare this to when they were not colluding: price was 26, Industry output was 40 (20 each) and industry profit was 800 (400 each)

Types of Quantity Competition
Cournot versus Stackelberg

- *Cournot duopoly :* Two firms decide on their outputs simultaneously. Each would not have any knowledge of other's actual output; but they anticipate each other's decisions.

- *Stackelberg (or leadership) duopoly:* One firm produces earlier; other firm follows and produces reactively. The leader firm perfectly anticipates the follower's reaction.

- *Stackelberg model: an* oligopoly model in which:
    – One firm assumes its rival will continue producing their current output (a la Cournot).
    – The other firm assumes its rival will produce on its Cournot reaction function.
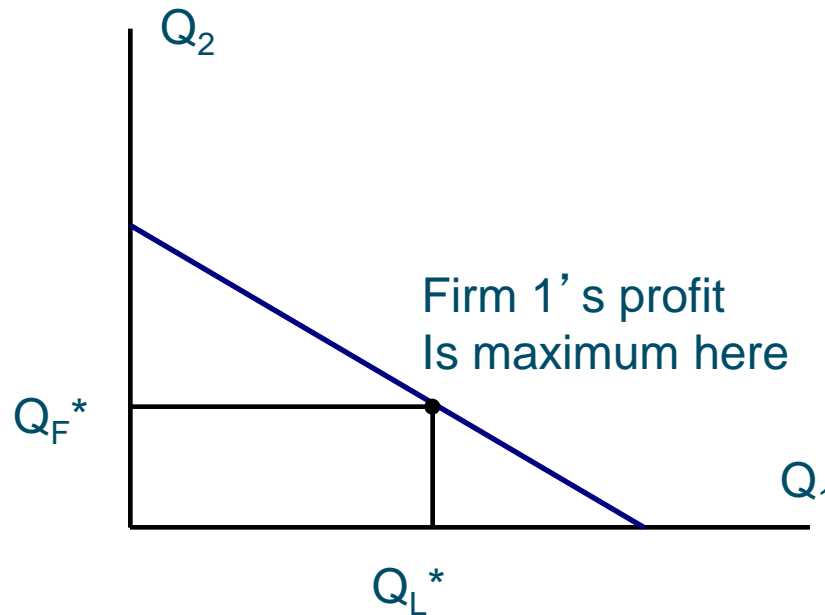
Cournot duopoly

- Equilibrium
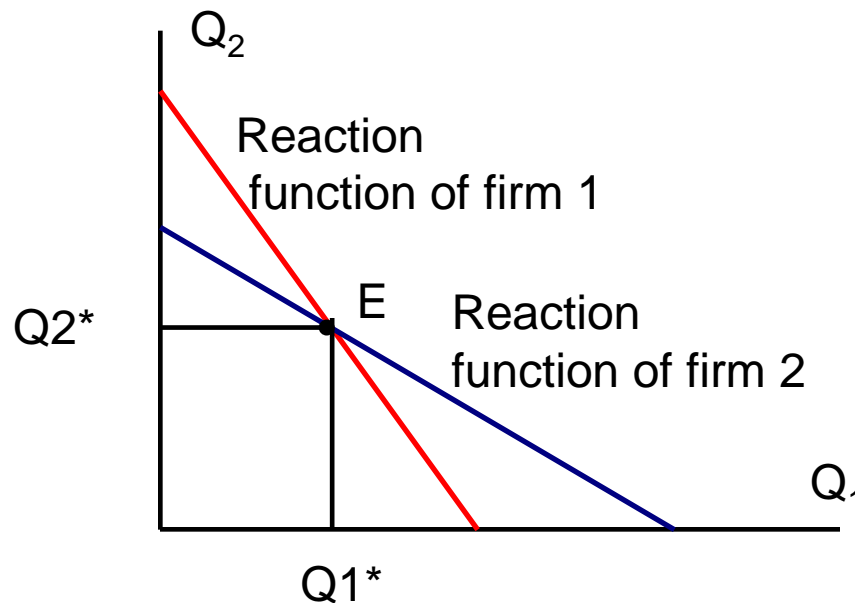
Since both firms choose outputs simultaneously, each firm's reaction must match with other's anticipation.

At point E that is true. Point E is the Cournot equilibrium.

Firms make positive profit.

University of East Anglia

- Reaction function of firm 2

The leader firm picks its most profitable point from firm 2's reaction function.

The leader firm gets first mover advantage. It produces a larger amount and forces firm 2 to react (optimally though).

Leader firm makes higher profit and the follower firm makes smaller (but still positive) profit.

Q_2

Firm 1's profit
Is maximum here

Q_F^*

Q_1

Q_L^*

The Stackelberg Model Example

- Given

    - Market demand is $P = 66 - Q$ where $Q = Q_1 + Q_2$

    - $MC_1 = MC_2 = 6$ (and costs are $2Q_1$ and $2Q_2$)

- Assumptions
    - One firm can set output first
    - Firm 1 (leader) sets output first and Firm 2 then makes an output decision

- Firm 1
    - Must consider the reaction of Firm 2

- Firm 2
    - Takes Firm 1's output as fixed and therefore determines output with the Cournot reaction curve: $Q_2 = 30 - Q_1/2$

The Stackelberg Model Example

- Firm 1 choose Q_l so that $\text{MR}_1 = MC_1$

  - Solve for MR_1 <u>given</u> firm <u>2's reaction function</u> $(Q_2 = 30 - Q_1/2)$

    - $p = 66 - (Q_1 + Q_2) = 66 - \left(Q_1 + 30 - \frac{Q_1}{2}\right) = 36 - \frac{Q_1}{2}$

    - $MR_1 = 36 - Q_1$

    - $MR_1 = MC_1 \rightarrow 36 - Q_1 = 6 \rightarrow Q_1^* = 30$

- Hence $Q_2^* = 30 - \frac{30}{2} = 15, \ Q_{TOT}^* = 45, p = 21$

- Profits: $\Pi_1 = (21 - 6)30 = 450; \Pi_2 = (21 - 6)15 = 225;$

- Firm 2's output and profit are double of Firm 1.

Is duopoly socially desirable?

- Yes, duopoly is preferable to monopoly from the society's point of view

- Duopoly produces much higher social welfare than monopoly

- Within duopoly social welfare wise
  - Price competition ranks first
  - Stackelberg output competition ranks second
  - Cournot output competition ranks third

Takeaway messages

- Competition in real markets happen at different levels

- In the short run, firms typically compete using prices or quantities

- Quantity competition is softer

- Firms strategically interact trying to anticipate and predict the decisions of the other firm

- We can predict their decisions too, with a little game theory