Microeconomics, 2nd Edition

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Chapter 13: Market Structure and Competition

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A Taxonomy of Market Structures

Market structures differ on four important dimensions:

- The number of sellers
- The number of buyers
- Entry conditions
- The degree of product differentiation

Definition: **Product Differentiation** between two or more products exists when the products possess attributes that, in the minds of consumers, set the products apart from one another and make them less than perfect substitutes.

Examples: Pepsi is sweeter than Coke, Brand Name batteries last longer than "generic" batteries.

Two types of differentiation:

- "Superiority" (*Vertical Product Differentiation*) i.e. one product is viewed as unambiguously better than another so that, at the same price, all consumers would buy the better product
- "Substitutability" (*Horizontal Product Differentiation*) i.e. at the same price, some consumers would prefer the characteristics of product A while other consumers would prefer the characteristics of product B.

Table 1: A Taxonomy of Market Structures

	Number of firms (sellers)			
Degree of Product Differentiation	Many	Few	One Dominant	One
Firms produce identical products	Perfect Competition	Oligopoly with homogeneous products	Dominant firm	Monopoly
Firms produce differentiated products	Monopolistic Competition	Oligopoly with differentiated products	----------	----------

Oligopoly

Assume: Many Buyers
Few Sellers

⇨Each firm faces downward-sloping demand because each is a large producer compared to the total market size

⇨There is no one dominant model of oligopoly… we will review several.

1. Bertrand Oligopoly (Homogeneous)

Assume: Firms set price*
Homogeneous product
Simultaneous
Noncooperative

*Definition: In a Bertrand oligopoly, each firm sets its price, taking as given the price(s) set by other firm(s), so as to maximize profits.

Definition: Firms act **simultaneously** if each firm makes its strategic decision at the same time, without prior observation of the other firm's decision.

Definition: Firms act **noncooperatively** if they set strategy independently, without colluding with the other firm in any way

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How will each firm set price?

⇨Homogeneity implies that consumers will buy from the low-price seller.

⇨Further, each firm realizes that the demand that it faces depends both on its own price and on the price set by other firms

⇨Specifically, any firm charging a higher price than its rivals will sell no output.

⇨Any firm charging a lower price than its rivals will obtain the entire market demand.

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Definition: The relationship between the price charged by firm i and the demand firm i faces is firm i's **residual demand**

In other words, the residual demand of firm i is the market demand minus the amount of demand fulfilled by other firms in the market: $Q_1 = Q - Q_2$

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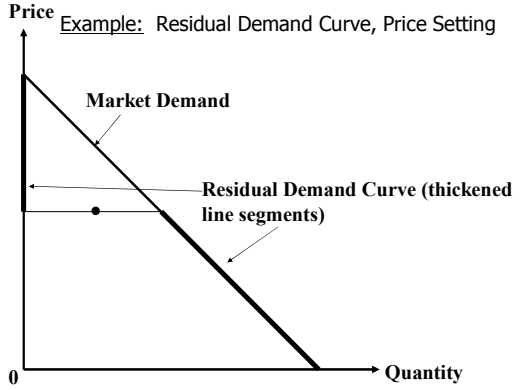
Price

Example: Residual Demand Curve, Price Setting



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•*Assume* firm always meets its residual demand (no capacity constraints)

•*Assume* that marginal cost is constant at c per unit.

•*Hence,* any price at least equal to c ensures non-negative profits.

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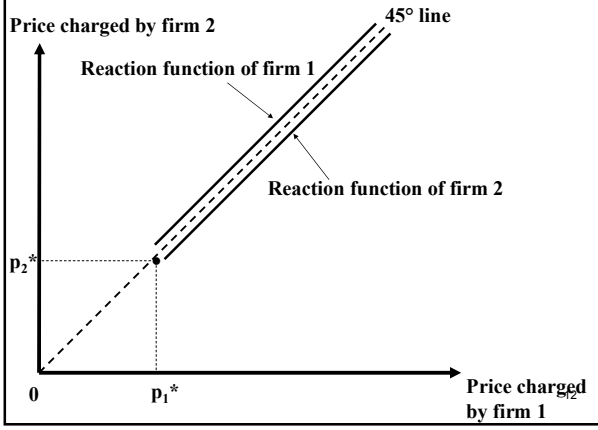
Example: Reaction Functions, Price Setting and Homogeneous Products



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Thus, each firm's profit maximizing response to the other firm's price is to undercut (as long as P > MC)

Definition: The firm's profit maximizing action as a function of the action by the rival firm is the firm's **best response (or reaction) function**

Example:

2 firms
Bertrand competitors

Firm 1's best response function is $P_1=P_2- e$
Firm 2's best response function is $P_2=P_1- e$

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Equilibrium:

If we assume no capacity constraints and that all firms have the same constant average and marginal cost of c then…

For each firm's response to be a best response to the other's each firm must undercut the other as long as P> MC

Where does this stop? P = MC (!)

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So…

1. Firms price at marginal cost
2. Firms make zero profits
3. The number of firms is irrelevant to the price level as long as more than one firm is present: two firms is enough to replicate the perfectly competitive outcome!

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Hotelling's (1929) linear city

- Why do all vendors locate in the same spot?
- For instance, on High Street many shoe shops right next to each other. Why do political parties (at least in the US) seem to have the same agenda?
- This can be explained by firms trying to get the most customers.

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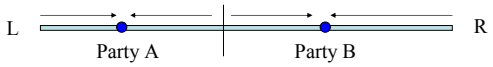
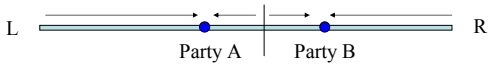
Hotelling (voting version)

Voters vote for the closest party.



If Party A shifts to the right then it gains voters.



Each has incentive to locate in the middle.

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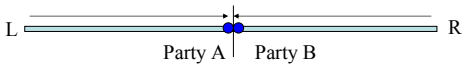
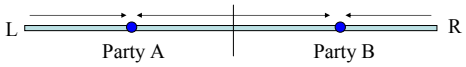
Hotelling Model



Average distance for voter is ¼ total. This isn't "efficient"!



Most "efficient" has average distance of 1/8 total.

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Further considerations: Hotelling

- Firms choose location and then prices.
- Consumers care about both distance and price.
- If firms choose close together, they will eliminate profits as in Bertrand competition.
- If firms choose further apart, they will be able to make some profit.
- Thus, they choose further apart.

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Bertrand Competition (Differentiated)

Assume: Firms set price*
Differentiated product
Simultaneous
Noncooperative

As before, differentiation means that lowering price below your rivals' will not result in capturing the entire market, nor will raising price mean losing the entire market so that residual demand decreases smoothly

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Example:

$Q_1 = 100 - 2P_1 + P_2$ *"Coke's demand"*
$Q_2 = 100 - 2P_2 + P_1$ *"Pepsi's demand"*

$MC_1 = MC_2 = 5$

What is firm 1's residual demand when Firm 2's price is $10? $0?

$Q_1^{10} = 100 - 2P_1 + 10 = 110 - 2P_1$
$Q_1^{0} = 100 - 2P_1 + 0 = 100 - 2P_1$

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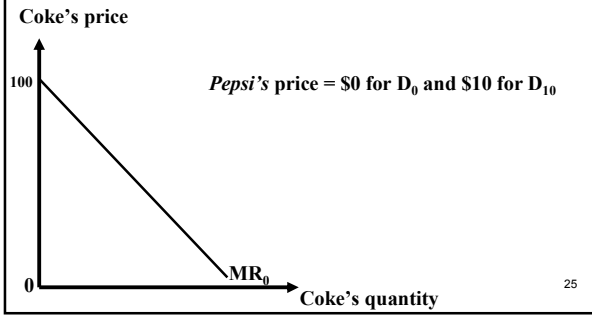
Example: Residual Demand, Price Setting, Differentiated Products
Each firm maximizes profits based on its residual demand by setting MR (based on residual demand) = MC



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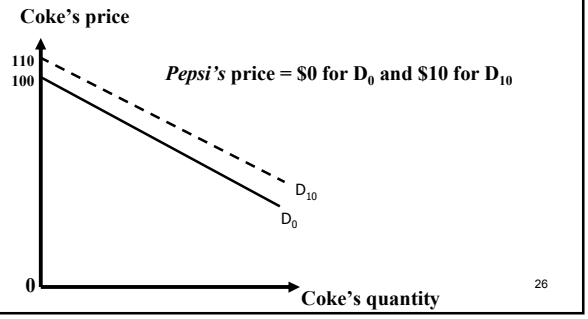

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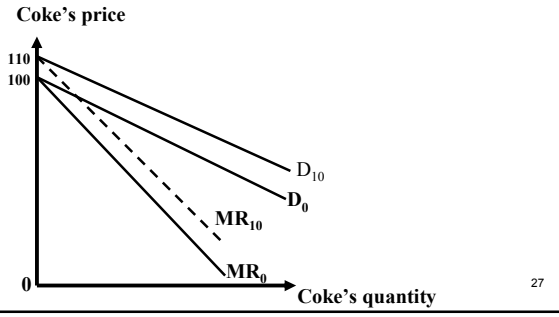
Pepsi's price = $0 for D_0 and $10 for D_{10}



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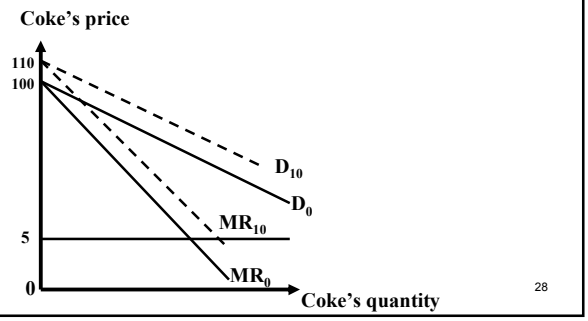

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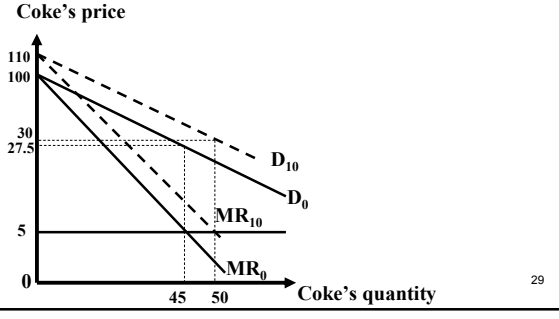

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Example:

$MR_1^{10} = 55 - Q_1^{10} = 5$

$\Rightarrow Q_1^{10} = 50$
$\Rightarrow P_1^{10} = 30$

Therefore, firm 1's best response to a price of $10 by firm 2 is a price of $30

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Example: Solving for firm 1's reaction function for any arbitrary price by firm 2

$P_1 = 50 - Q_1/2 + P_2/2$

$MR = 50 - Q_1 + P_2/2$

$MR = MC \Rightarrow Q_1 = 45 + P_2/2$

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And, using the demand curve, we have:

$P_1 = 50 + P_2/2 - 45/2 - P_2/4$ …or…
$P_1 = 27.5 + P_2/4$…*reaction function*

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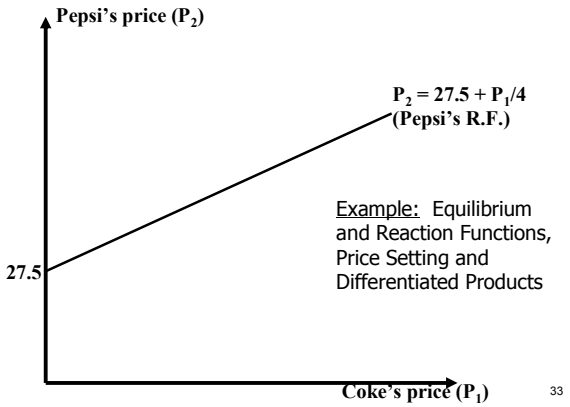

Example: Equilibrium and Reaction Functions, Price Setting and Differentiated Products

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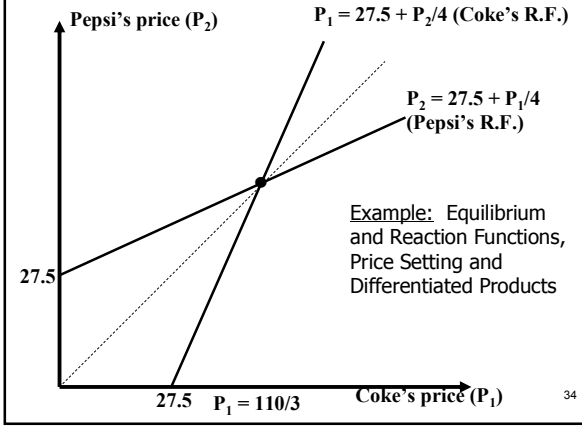

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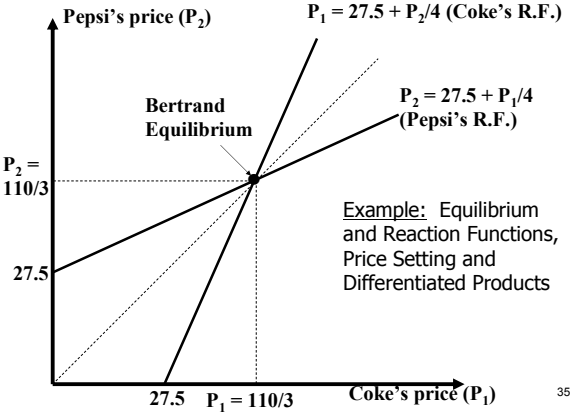

Example: Equilibrium and Reaction Functions, Price Setting and Differentiated Products

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Equilibrium:

Equilibrium occurs when all firms simultaneously choose their best response to each others' actions.

Graphically, this amounts to the point where the best response functions cross...

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Example: Firm 1 and firm 2, continued

$P_1 = 27.5 + P_2/4$
$P_2 = 27.5 + P_1/4$

Solving these two equations in two unknowns…

$P_1^* = P_2^* = 110/3$

Plugging these prices into demand, we have:

$Q_1^* = Q_2^* = 190/3$

$\pi_1^* = \pi_2^* = 2005.55$
$\Pi = 4011.10$

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Notice that

1. profits are positive in equilibrium since both prices are above marginal cost!

⇨Even if we have no capacity constraints, and constant marginal cost, a firm cannot capture all demand by cutting price…

⇨This blunts price-cutting incentives and means that the firms' own behavior does not mimic free entry

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⇨Only if I were to let the number of firms approach infinity would price approach marginal cost.

2. Prices need not be equal in equilibrium if firms not identical (e.g. Marginal costs differ implies that prices differ)

3. The reaction functions slope upward: "aggression => aggression"

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(Chamberlinian) Monopolistic Competition

Market Structure: Many Buyers
Many Sellers
Free entry and Exit
(Horizontal) Product Differentiation

Example: Restaurants, Local markets for doctors

⇨When firms have horizontally differentiated products, they each face downward-sloping demand for their product because a small change in price will not cause ALL buyers to switch to another firm's product.

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⇨Monopolistic Competition in the Short Run: (fixed number of firms)

1. Each firm is small => each takes the observed "market price" as given in its production decisions.

2. Since market price may not stay given, the firm's *perceived* demand may differ from its *actual* demand.

3.If all firms' prices fall the same amount, no customers switch supplier but the total market consumption grows.

4. If only one firm's price falls, it steals customers from other firms *as well as* increases total market consumption

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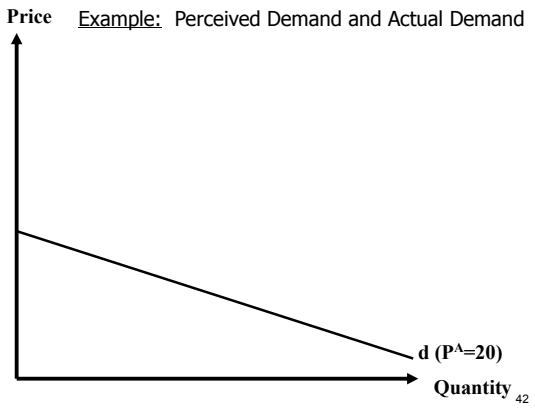

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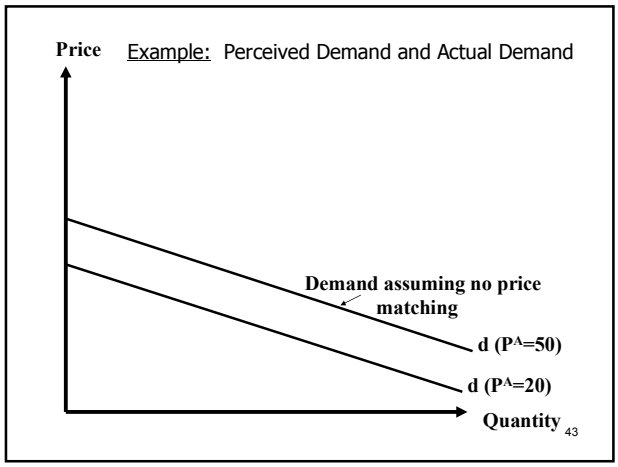

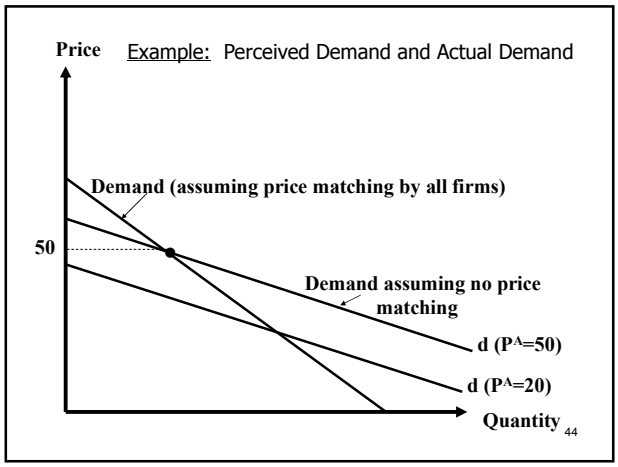

The market is in equilibrium if…

⇨each firm maximizes profit taking the *average* market price as given

⇨each firm can sell the quantity it desires at the *actual* average market price that prevails

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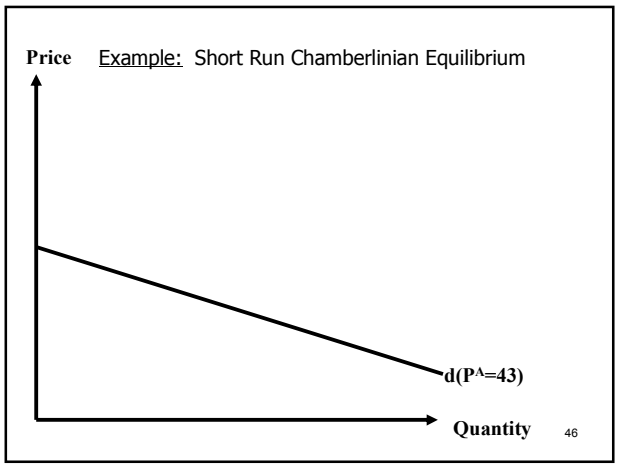
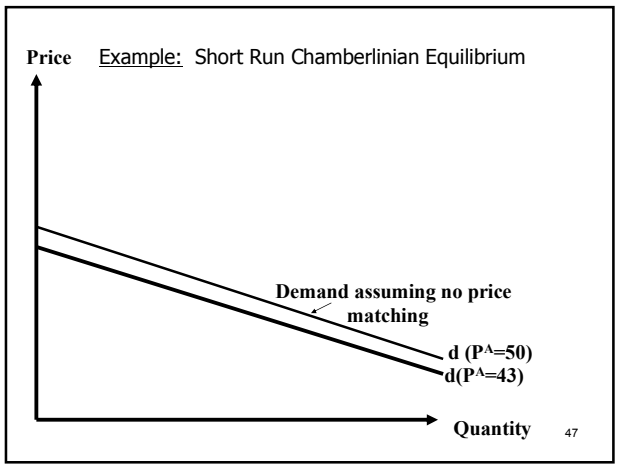
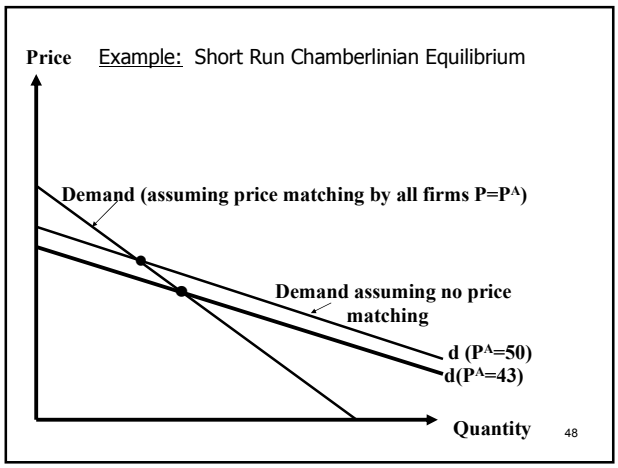
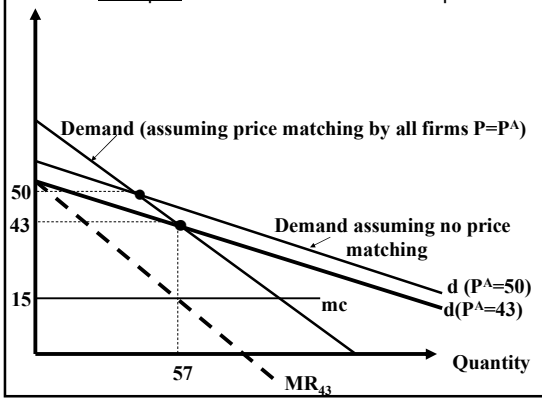






Price Example: Short Run Chamberlinian Equilibrium



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Example: Computing A Short-Run Monopolistically Competitive Equilibrium

MC = \$15

N = 100

$Q = 100 - 2P + P^A$

Where: P^A is the average market price
N is the number of firms

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a. *What is the equation of d_{40}? What is the equation of D?*

d_{40}: $Q^d = 100 - 2P + 40 = 140 - 2P$

D: Note that $P = P^A$ so that

$Q^D = 100 - P$

b. *Show that d_{40} and D intersect at P = 40*

P = 40 => $Q^d = 140 - 80 = 60$
$Q^D = 100 - 40 = 60$

c. *For any given average price, P^A, find a typical firm's profit maximizing quantity*

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Inverse (perceived) demand:

$P = 50 - (1/2)Q + (1/2)P^A$

⇨$MR = 50 - Q + (1/2)P^A$

⇨$MR = MC \Rightarrow 50 - Q + (1/2)P^A = 15$

⇨$Q^e = 35 + (1/2)P^A$

⇨$P^e = 50 - (1/2)Q^e + (1/2)P^A$
$P^e = 32.5 + (1/4)P^A$

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d. *What is the short run equilibrium price in this industry?*

In equilibrium, $Q^e = Q^D$ at P^A so that

$100 - P^A = 35 + (1/2)P^A$

$P^A = 43.33$
$Q^e = 56.66$
$Q^D = 56.66$

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⇨Monopolistic Competition in the Long Run

At the short run equilibrium P ≥ AC so that each firm may make positive profit.

Entry shifts d and D left until average industry price equals average cost.

This is long run equilibrium is represented graphically by:

- MR = MC for each firm
- D = d at the average market price
- d and AC are tangent at average market price

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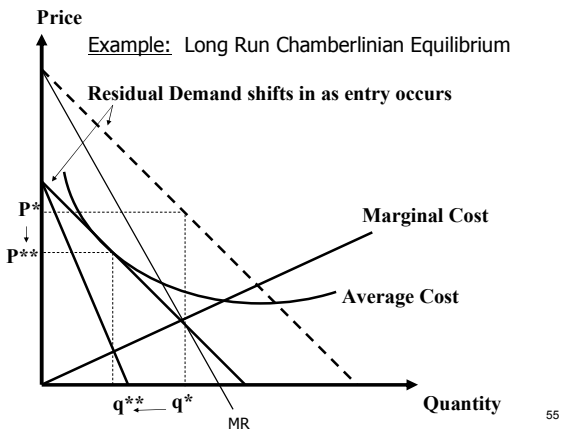

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Theory vs. Observation: Do Prices Rise with Concentration?

US Manufacturing Industries

CR8	Average Profit Rate
>70	12.1%
<70	6.9%

Source: Bain, Joe S., "Relation of Profit Rate to Industry Concentration: American Manufacturing, 1936-1940," *Quarterly Journal of Economics*, v. 65 (August 1951), pp. 293-324 and *Barriers to New Competition* (Cambridge: Harvard University Press, 1956).

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