Microeconomics
Class 8

Price Discrimination
(Chapter 11.2)

Andras Niedermayer
Cergy Paris Université
Fall 2020

Introduction

- Without market power (i.e. in a market with perfect competition), pricing is determined by supply and demand. An individual firm must be able to anticipate market fluctuations, and set production so that MC = P.

- When a firm has *market power* (i.e. in a market with *imperfect* competition), it can make larger profits. But to do so, it needs a better knowledge of the demand (in particular its elasticity) in order to choose the proper quantity (MC = MR) and to fix the price.

1. Capturing Consumer surplus

The profit maximizing quantity q^* satisfies the equation $MR(q^*) = MC(q^*)$, and the price p^* is determined by the demand (=AR) curve: $p^* = D(q^*)$.

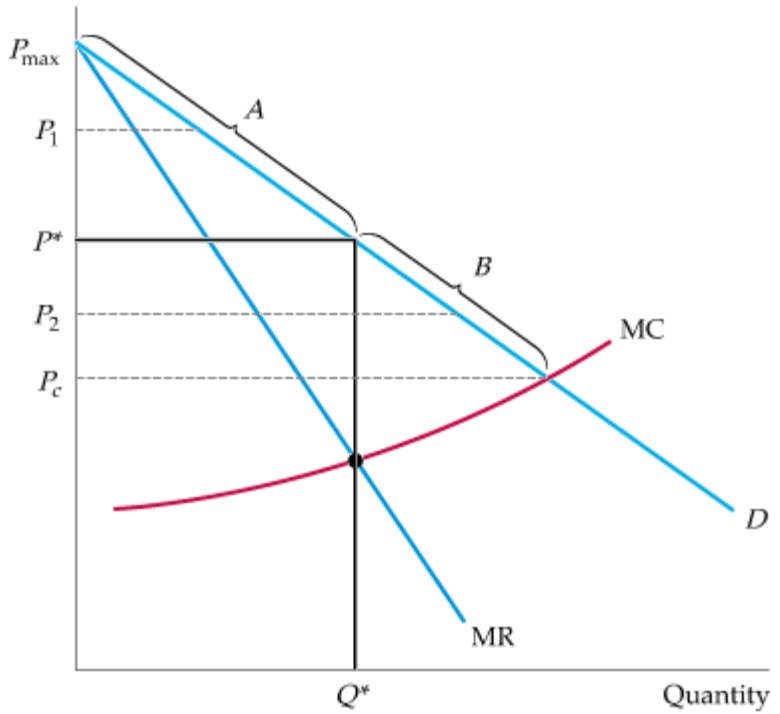
This choice is the result of the tradeoff the monopoly faces. Some consumers are willing to pay more than p^* to buy the good. The monopoly would like to charge these customers a higher price. But if it raises the price for *all* customers, then other customers will stop buying the good, which would reduce sales and hurt profits.

To resolve this tradeoff, monopolist firms often try to raise the profits with more complex pricing strategies, which exploit the fact that some consumers are willing to pay more than p^* in order to obtain the good.

We will consider several strategies used by monopolies in order to capture a share of consumer surplus that they cannot obtain with standard monopoly pricing…

If a firm can charge only one price for all its customers, that price will be P^* and the quantity produced will be Q^*.

Ideally, the firm would like to charge a higher price to consumers willing to pay more than P^*, thereby capturing some of the consumer surplus under region *A* of the demand curve.



The firm would also like to sell to consumers willing to pay prices lower than P^*, but only if doing so does not entail lowering the price to other consumers.

In that way, the firm could also capture some of the surplus under region *B* of the demand curve.

The firm resolves this problem through ***price discrimination***. This is the practice of charging different prices to different consumers for similar goods.

Certain conditions are necessary for price discrimination to be feasible.

First, the firm must have *market power* (i.e. some degree of monopoly power).

Second, it needs precise information about the demand curves (i.e. reservation prices) of different groups of the consumers.

Third, it must be able to learn the group to which each consumer belongs. Consumers will of course lie if you simply ask them to reveal their reservation price for the good. So the firm must use a clever strategy to induce them to "inadvertently reveal" this information through their behaviour.

Finally, the firm must be able to forbid resale (or, at least, to make it costly).

First-degree Price Discrimination

In ***first-degree price discrimination***, each consumer pays a different price.

The price charged to each consumer is equal to the maximum price that she is willing to pay for the good : her ***reservation price***.

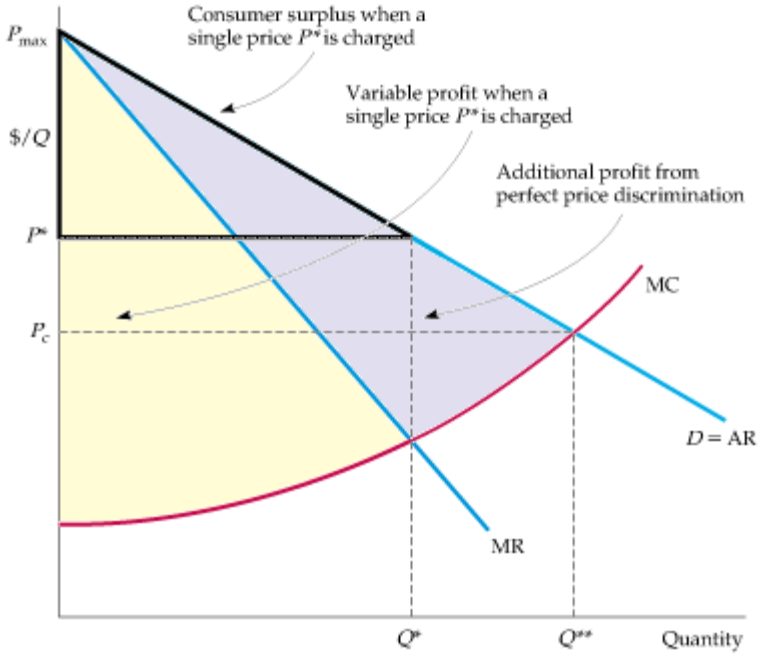
This strategy allows the monopoly firm to increase its profit by capturing *all* of the consumer surplus that would have been realized in a competitive equilibrium.

First-Degree Price Discrimination

When only a single price, P^*, is charged, the firm's variable profit is the yellow area between the marginal revenue and marginal cost curves.

If the firm could charge each consumer her reservation price, then it would be profitable to expand output to Q^{**}.

Thus, with *perfect* price discrimination, profit would expands to include the purple area between the demand curve and the marginal cost curve.



- **variable profit** Sum of profits on each incremental unit produced by a firm; i.e., profit ignoring fixed costs.

First-degree Price Discrimination

If the firm can perfectly price discriminate, each consumer pays a price equal to his reservation price.

The MR curve is no longer used by the firm to choose a price or a quantity.

The marginal revenue of a unit of the good is now equal to the price this unit is sold (i.e. the demand curve).

The additional profit made with an extra unit is equal to the difference between the demand curve and the marginal cots curve (see graph).

First-degree Price Discrimination

In practice, perfect first-degree price discrimination is almost impossible :

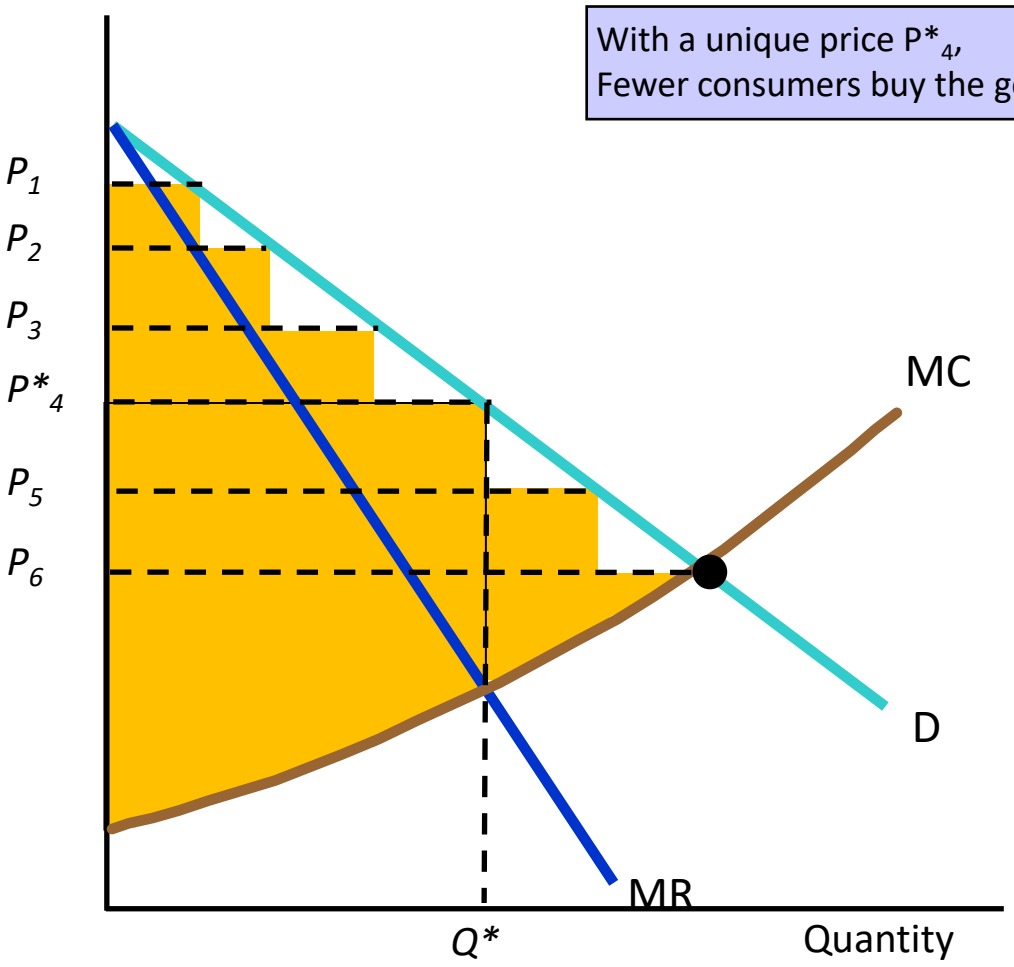
It is extremely difficult to charge a different price for each consumer (except if there are very few consumers).

In general, firms do not know the precise reservation price of each consumer.

However, firms may be able to *imperfectly* discriminate :

They can fix a set of different prices depending on estimated reservation prices for different groups of consumers.

First-degree Price Discrimination in Practice



Instead, the firm charges 6 different prices (P_1 - P_6) in order
To raise its profit.

(Note that P_6 is the perfect competition price).

This raises the firm's profit.

Examples of imperfect price discrimination

Lawyers, doctors, accountants or architects can adapt their pricing strategies to different classes of clients.

Car dealers (average profit margin in the sector : 15 %).

Private universities in U.S. (different tuitions fees; various “scholarships” or “partial fee waivers” act essentially to create a whole menu of different effective prices targeted at different groups of customers students).

Second-degree Price Discrimination

In *first-degree* price discrimination, the firm can distinguish each consumer and her reservation price. Also, the firm can "isolate" customers and deal with each one separately. So each customer faces a different price.

Now suppose firm knows each consumer's reservation price, but it cannot isolate them. Every customer has access to all the offers (due to legal or physical constraints). So first-degree price discrimination is not possible.

However, customers could purchase varying quantities, and their reservation price for marginal consumption is decreasing function of the quantity they have already purchased. The firm can exploit this information to offer them different prices for different quantities. This is called ***second-degree price discrimination***.

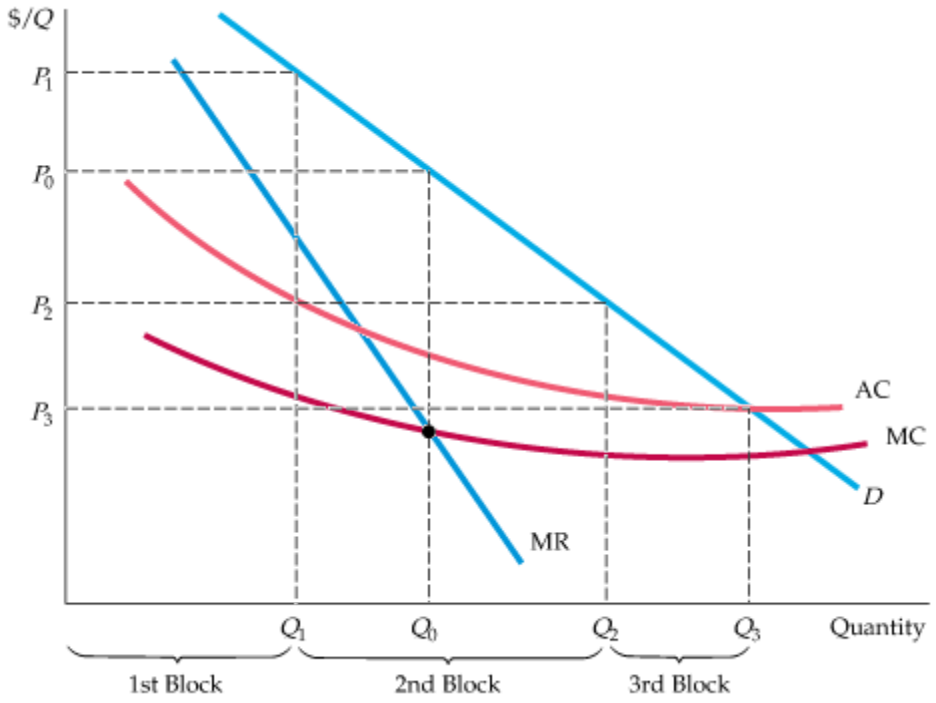
Examples : Different serving sizes in restaurants (e.g. *tall*, *grande*, *vente* at *Starbucks*). Different package sizes for food or other products at supermarket. "Bulk discounts". Different "billing plans" for water, electricity, cell phones.

Second-Degree Price Discrimination

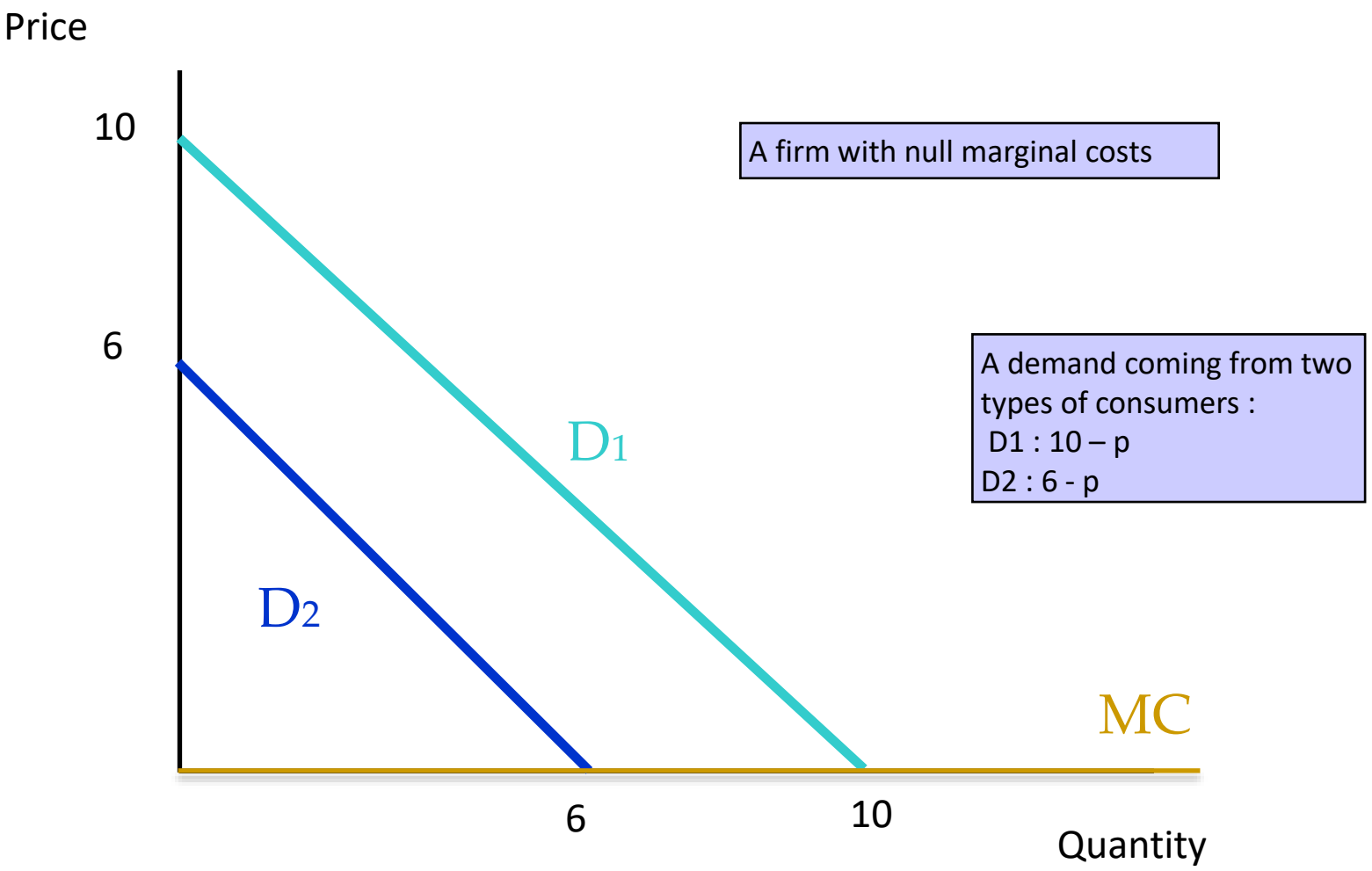
One form of second-degree price discrimination is ***block pricing***. This means charging different prices for different quantities or "blocks" of a good.

Different prices are charged for different quantities, or "blocks," of the same good. Here, there are three blocks, with corresponding prices P_1, P_2, and P_3.

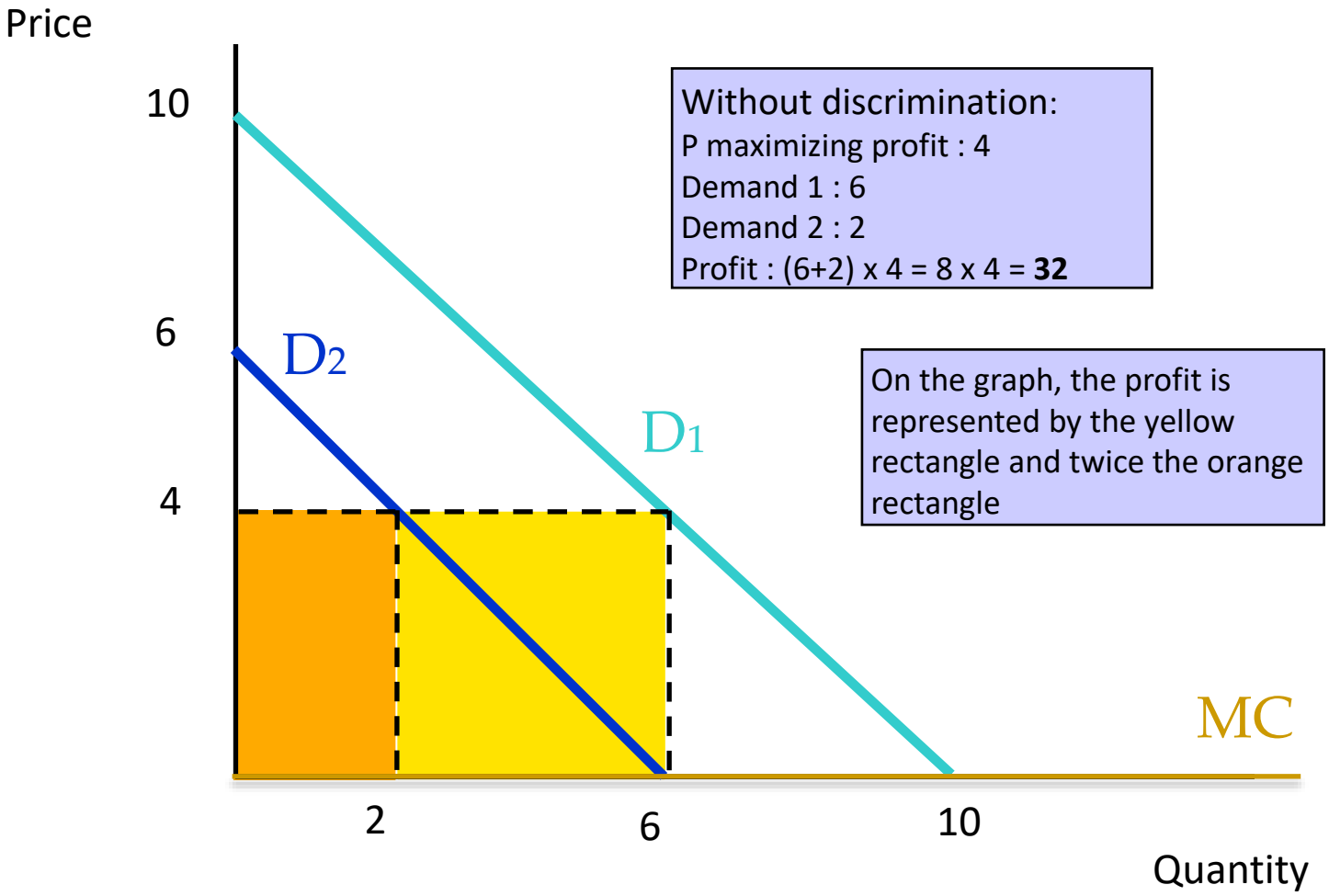
Sometimes there are also *economies of scale* in production: average and marginal costs are declining. Second-degree price discrimination can then make consumers better off by expanding output and lowering per-unit cost for consumers who wish to purchase a large quantity.



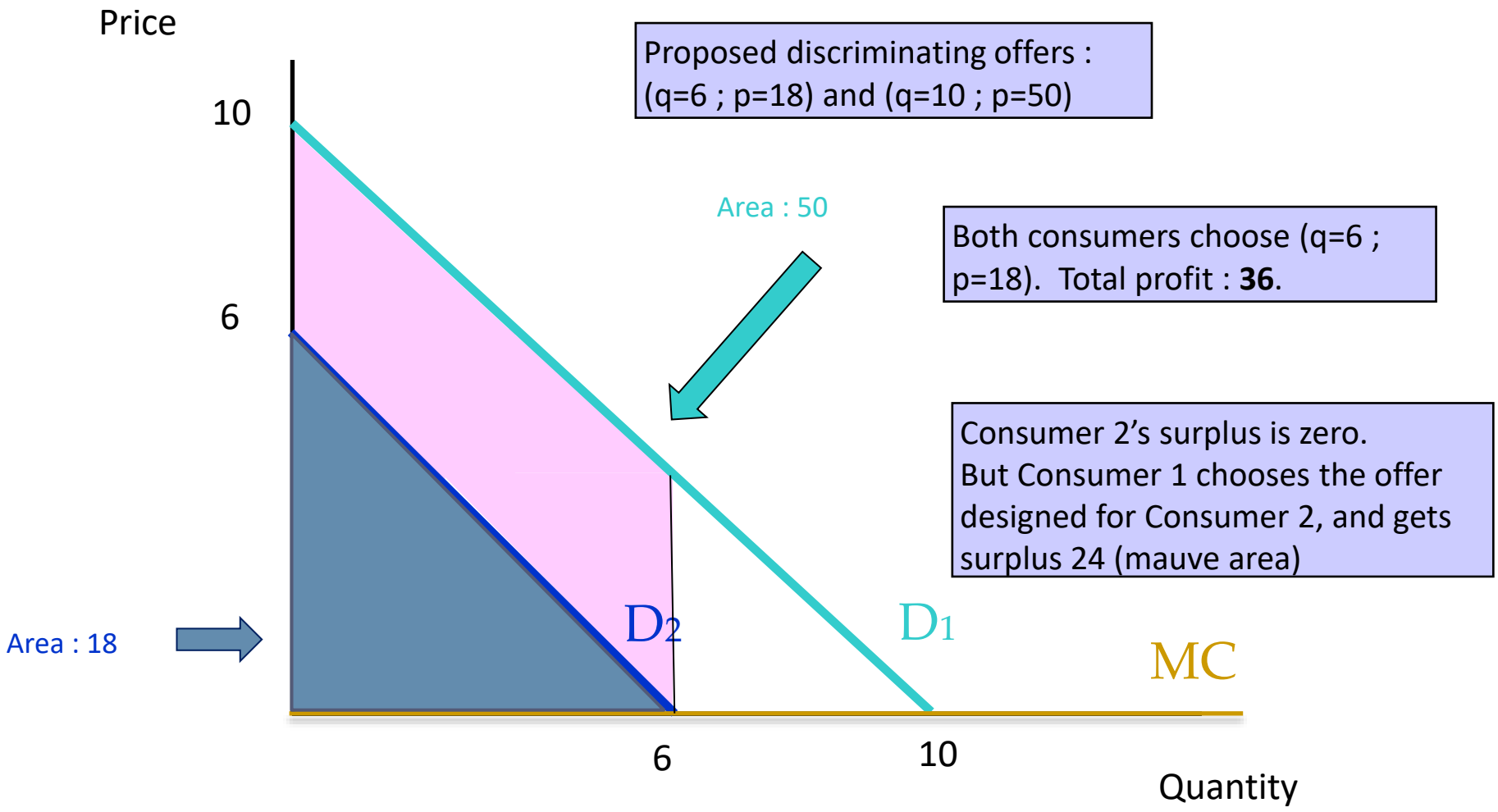
Example – Elements



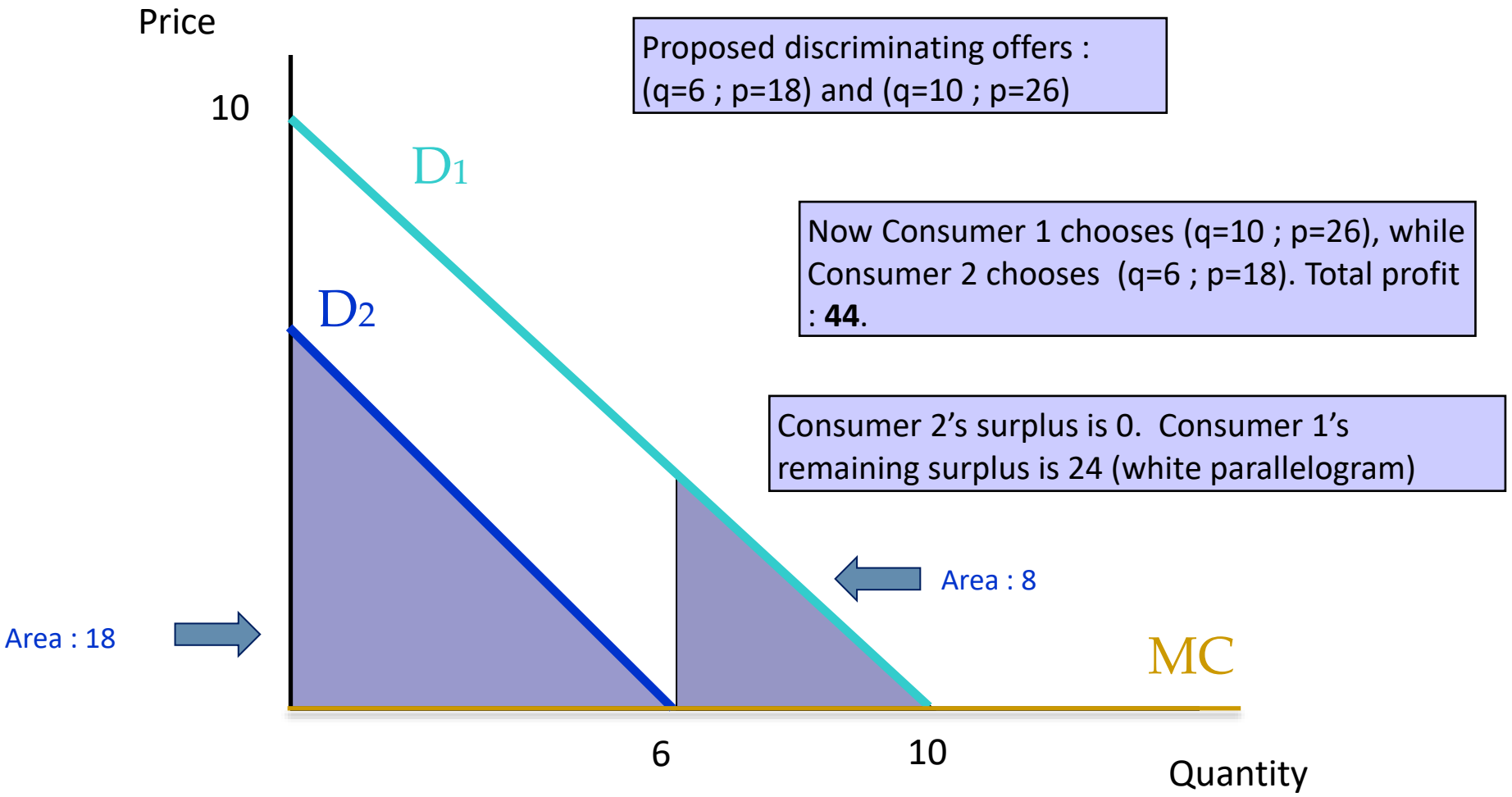
Example – without discrimination



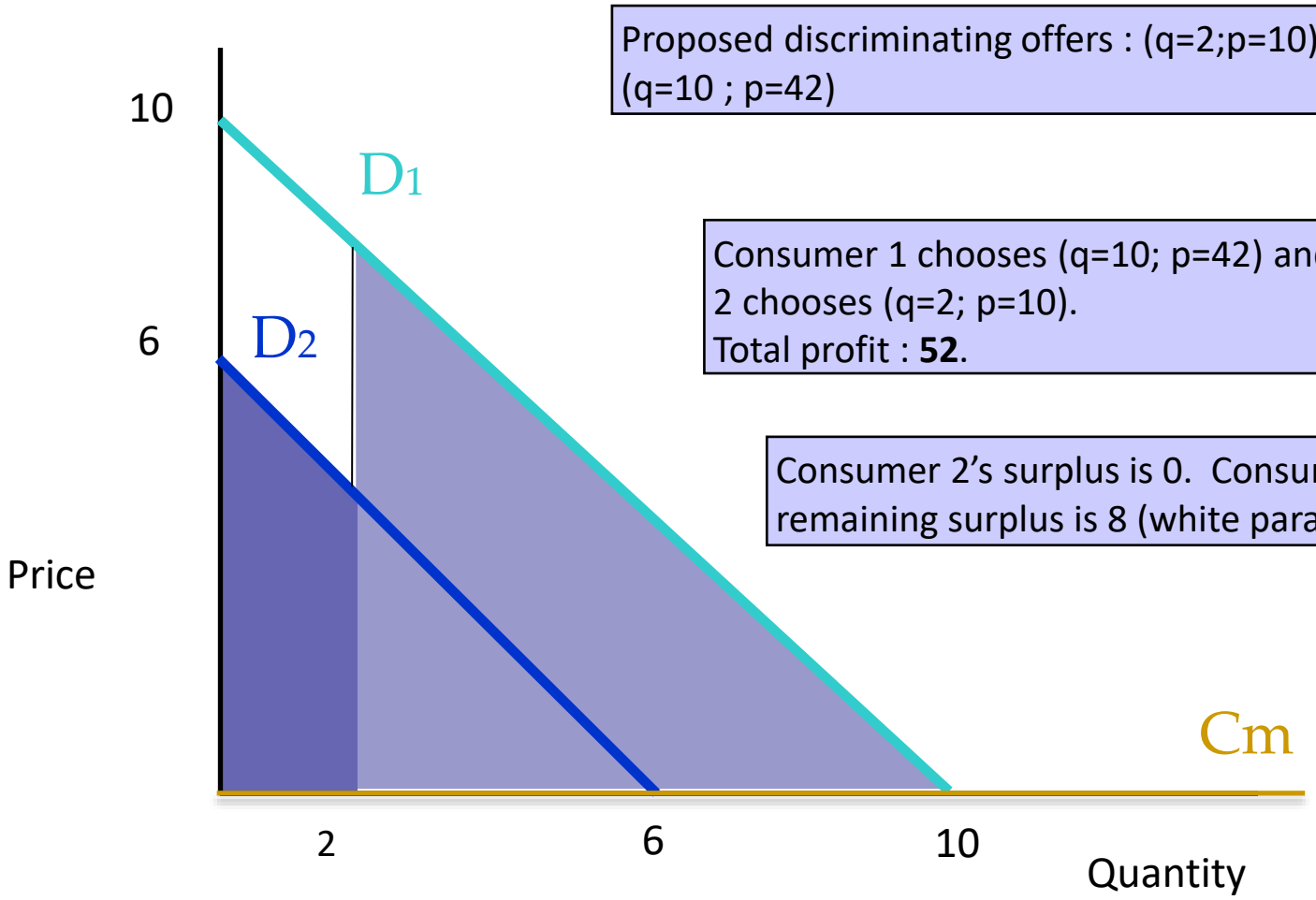
Example – First try



Example - Improvements



Example - Solution



Third-Degree Price Discrimination

Third-degree price discrimination is the practice of dividing consumers into two or more groups with separate demand curves for each group (e.g "budget" vs. "premium" customers), and then charging different prices to each group.

Creating Consumer Groups

Assuming third-degree price discrimination is feasible, how should the firm decide what price to charge each group of consumers?
There are two principles:

1. However much is produced, total output should be divided between the groups of customers so that *marginal revenues coming from each group are equal*. (Otherwise you should transfer some sales from group generating lower MR to group with generating higher MR).

2. *Total* output must be such that the marginal revenue for each group of consumers is equal to the marginal cost of production.

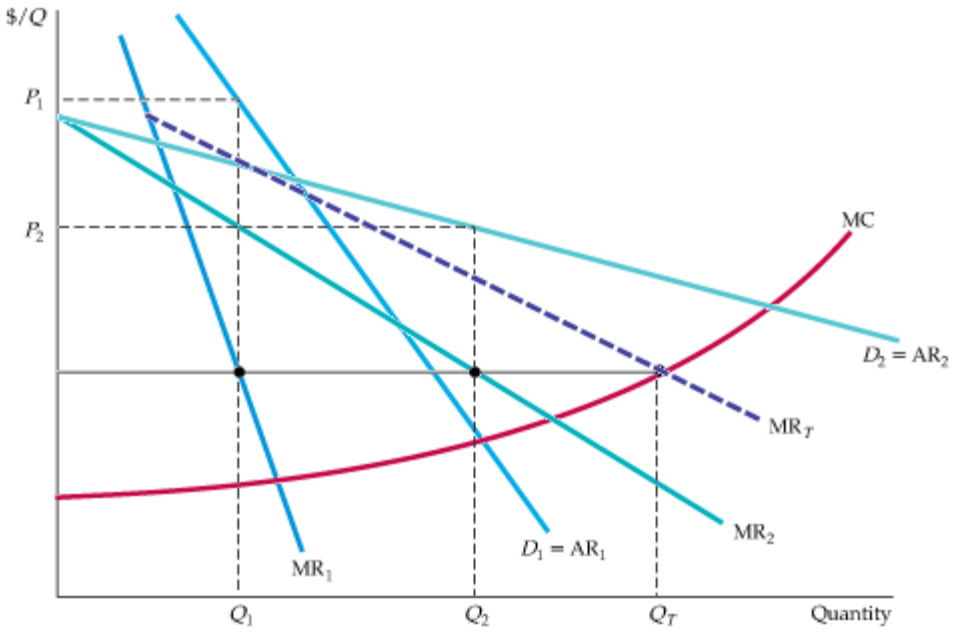
Third-Degree Price Discrimination

Consumers are divided into two groups, with separate demand curves for each group. The optimal prices and quantities are such that the marginal revenue from each group is the same and equal to marginal cost.

Here group 1, with demand curve D_1, is charged P_1, and group 2, with the more elastic demand curve D_2, is charged the lower price P_2.

Marginal cost depends on the total quantity produced Q_T.

Note that Q_1 and Q_2 are chosen so that $MR_1 = MR_2 = MC$.



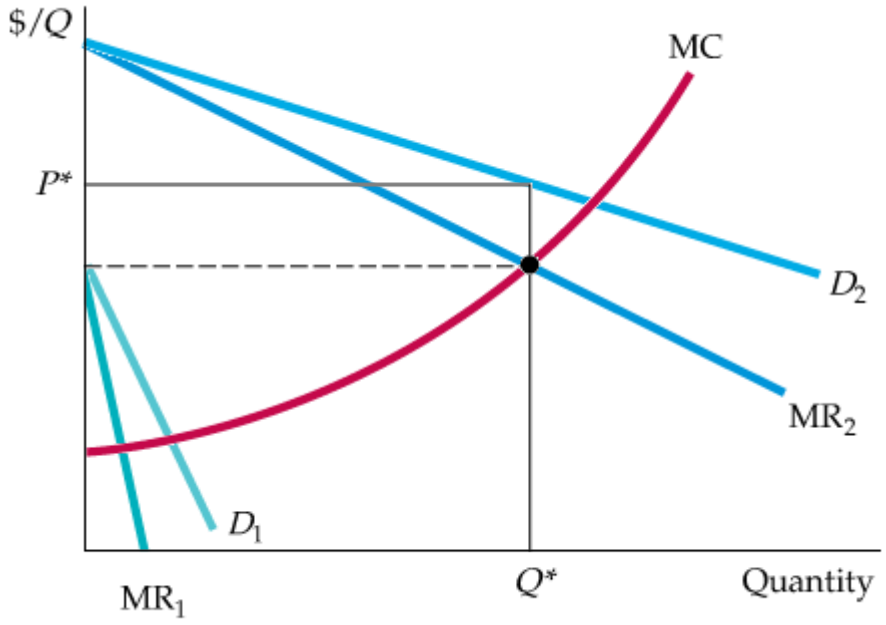
Third-Degree Price Discrimination

Even if third-degree price discrimination is feasible, it may not pay to sell to both groups of consumers if marginal cost is rising.

Here the first group of consumers, with demand D_1, are not willing to pay much for the product.

It is unprofitable to sell to them because the price would have to be too low to compensate for the resulting increase in marginal cost.

No Sales to Smaller Market



Third-Degree Price Discrimination

In third-degree price discrimination with two groups, total profit is given by:

$$\pi = P_1 Q_1 + P_2 Q_2 - C(Q_T)$$

where P1 and P2 are the two prices, and Q1 and Q2 the quantities.
The profit-maximizing level of Q1 must satisfy the first order conditions:

$$\frac{\Delta \pi}{\Delta Q_1} = \frac{\Delta (P_1 Q_1)}{\Delta Q_1} - \frac{\Delta C}{\Delta Q_1} = 0$$

Thus, $\mathrm{MR}_1 = \mathrm{MC}$

By a similar argument, we have $\mathrm{MR}_2 = \mathrm{MC}$

Thus, the optimal solution satisfies: $\mathrm{MR}_1 = \mathrm{MR}_2 = \mathrm{MC}$

For both groups, the "rule of thumb" for monopoly pricing applies:

$$\mathrm{MR} = P(1 + 1/E_d)$$

Thus, we conclude that $\frac{P_1}{P_2} = \frac{(1+1/E_2)}{(1+1/E_1)}$

PRICE DISCRIMINATION

EXAMPLE 11.1 The Economics of Coupons and Rebates

Coupons provide a means of third-degree price discrimination.

Studies show that only about 20 to 30 percent of all consumers regularly bother to clip, save, and use coupons.

Rebate programs work the same way.

Only those consumers with relatively price-sensitive demands bother to send in the materials and request rebates.

Thus, coupons and rebates separate customers into two groups: those with more elastic ("price sensitive") demand, and those with less elastic ("price-insensitive") demand. Thus, they provide a mechanism for third-degree price discrimination.

EXAMPLE 11.1 The Economics of Coupons and Rebates (continued)

TABLE 11.1 Price Elasticities of Demand for Users versus Nonusers of Coupons

	PRICE ELASTICITY	
Product	**Nonusers**	**Users**
Toilet tissue	−0.60	−0.66
Stuffing/dressing	−0.71	−0.96
Shampoo	−0.84	−1.04
Cooking/salad oil	−1.22	−1.32
Dry mix dinners	−0.88	−1.09
Cake mix	−0.21	−0.43
Cat food	−0.49	−1.13
Frozen entrees	−0.60	−0.95
Gelatin	−0.97	−1.25
Spaghetti sauce	−1.65	−1.81
Creme rinse/conditioner	−0.82	−1.12
Soups	−1.05	−1.22
Hot dogs	−0.59	−0.77

PRICE DISCRIMINATION

EXAMPLE 11.2 Airline Fares

Travelers are often amazed at the variety of fares available for round-trip flights from New York to Los Angeles.

Recently, for example, the first-class fare was above $2000; the regular (unrestricted) economy fare was about $1700, and special discount fares (often requiring the purchase of a ticket two weeks in advance and/or a Saturday night stayover) could be bought for as little as $400.

These fares provide a profitable form of third-degree price discrimination. The gains from discriminating are large because different types of customers, with very different elasticities of demand, purchase these different types of tickets.

TABLE 11.2 Elasticities of Demand for Air Travel

	FARE CATEGORY		
Elasticity	**First Class**	**Unrestricted Coach**	**Discounted**
Price	−0.3	−0.4	−0.9
Income	1.2	1.2	1.8

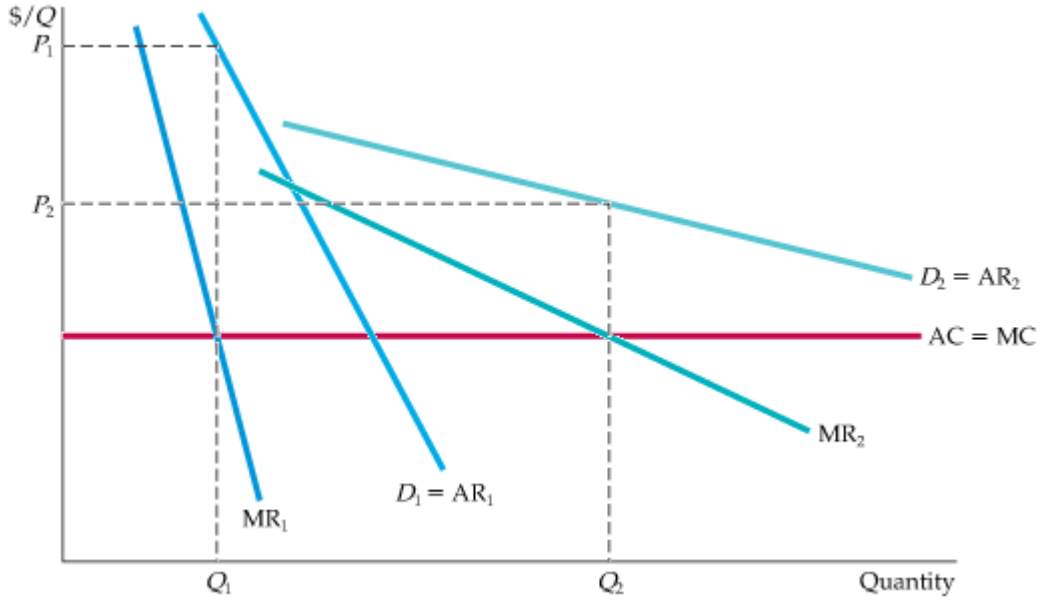
Intertemporal Price Discrimination and peak-load pricing

Intertemporal price discrimination is the practice of separating consumers with different demand functions into different groups by charging different prices at different points in time.

Consumers are divided into groups by changing the price over time.

Initially, the price is high. The firm captures surplus from "impatient" consumers who have a high demand for the good and who are unwilling to wait to buy it.

Later the price is reduced to appeal to "low-demand" consumers who are willing to wait for a cheaper price…



EXAMPLE 11.3 How to Price a Best-Selling Novel

Publishing both hardbound and paperback editions of a book allows publishers to price

Some consumers want to buy a new bestseller as soon as it is released, even if the price is $25. Other consumers, however, will wait a year until the book is available in paperback for $10.

The key is to divide consumers into two groups, so that those who are willing to pay a high price do so and *only* those unwilling to pay a high price wait and buy the paperback.

It is clear, however, that those consumers willing to wait for the paperback edition have demands that are far more elastic than those of bibliophiles.

It is not surprising, then, that paperback editions sell for so much less than hardbacks.

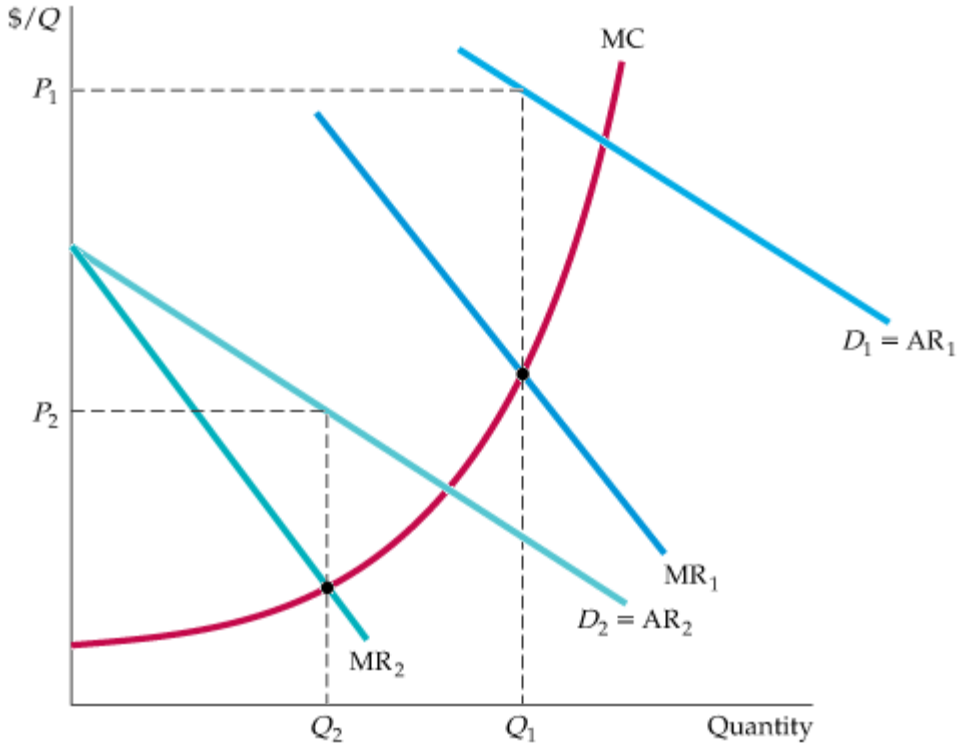
Peak-Load Pricing

Intertemporal price discrimination should not be confused with ***peak-load pricing*****:** this is the practice of charging higher prices during peak periods when capacity constraints cause marginal costs to be high.

Demands for some goods and services increase sharply during particular times of the day or year.

Charging a higher price P_1 during the peak periods is more profitable for the firm than charging a single price at all times.

It is also more efficient because marginal cost is higher during peak periods.



11.4

THE TWO-PART TARIFF

Another kind of price discrimination is a ***two-part tariff*****.** This is a form of pricing in which customers are first charged an ***entry fee***, and then charged a ***usage price*** for each unit consumed.

Examples:

- Amusement parks (Parc Astérix, Disneyland).
- Trade shows with entry fee.
- Nightclubs with a "cover charge".
- Athletic clubs or country clubs with annual membership fee.
- Cell phone plans.
- Brand-name razors (special blades sold separately).
- Laser printers and ink cartridges.
- Volkswagen cars that can only use special VW replacement parts.
- Any machine that can only use special "brand name" consumables or replacement parts (special batteries, light bulbs, etc.)

The goal of the firm is to structure the entry fee and usage price so as to extract the *maximum amount of surplus* from consumers, and thus increase its profits.

THE TWO-PART TARIFF

To illustrate, here is how a two-part tariff would work with a single customer.

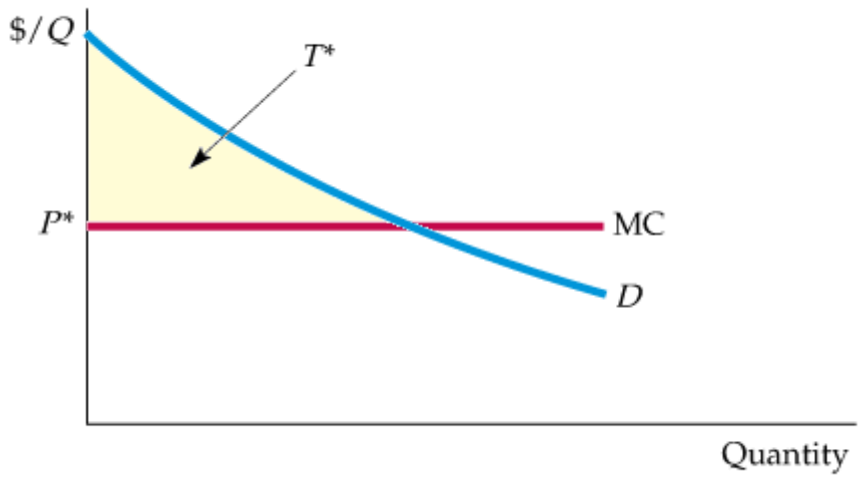
For simplicity, we assume there is a constant marginal cost of production, MC. Thus, the firm must set the usage fee P $\geq$ MC (otherwise it will lose money on every unit it sells). Suppose the firm sets P = MC. How can it maximize profit?

Suppose the consumer has demand curve *D*. The *largest* entry fee the consumer would be willing to pay is *T**, the total size of her surplus (the yellow triangle).

Thus, firm maximizes profit by setting usage fee *P* equal to marginal cost, and sets the entry fee *T** equal to the entire surplus of the consumer.

In this way, the consumer is still (just barely) willing to pay the fee, and firm extracts her entire surplus.

(This strategy also works with *many* customers, as long as they have identical demand curves.)



If there are multiple customers with different demand curves, then it is more complicated to find the profit-maximizing two-part tariff.

For simplicity, suppose there are *two* customers, with demand curves D_1 and D_2. Again suppose marginal cost of production is a constant MC.

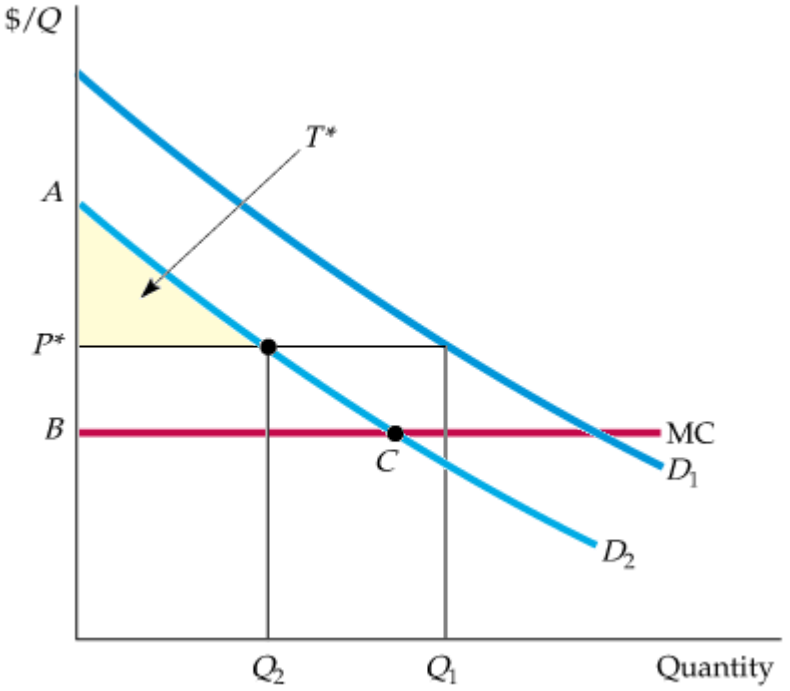
If the firm sets P = MC, then the *largest* value it can set for the usage fee is the total surplus of consumer D_2 (i.e. the area of triangle ABC) — otherwise consumer D_2 will not pay the fee, and we lose her business. In this case, profit = 2 x area(ABC).

But this is not profit-maximizing.

Instead, it is better to set the usage fee P *higher* than MC (like a monopoly), and then set the entry fee T^* to equal the surplus of the consumer with the *smaller demand*. (The area of yellow triangle)

The resulting profit is $2T^* + (P^* - \text{MC})(Q_1 + Q_2)$.

This is more than twice the area of triangle *ABC*. (To solve for the *optimal* values P^* and T^*, we must know the exact demand curves D_1 and D_2.)



If there are many customers with many different demand curves, the designing the optimal two-part tariff is a subtle problem. The firm faces a tradeoff: a lower entry fee T means more people will enter (meaning more per-unit sales), but also means less profits from the entry fee itself.

The next figure illustrates this tradeoff. In this figure, the **total** profit π is the sum of the profit from the **entry fee** π_a and the profit from **sales** π_s. These depend on both T and P:

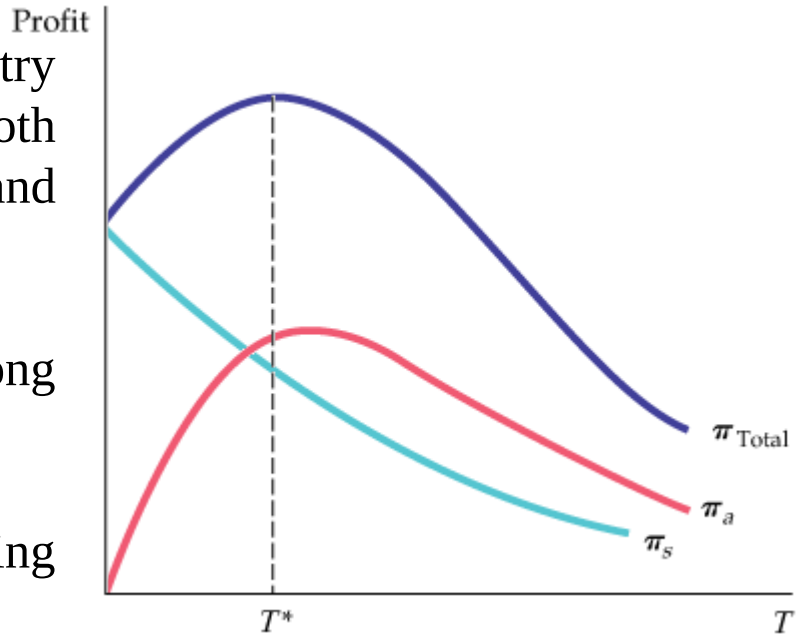
$\pi_a = n(T,P)\, T$, where $n(T,P)$ is the number of entrants (a function of T and P), and
$\pi_s = (P - \mathrm{MC})\, Q[P, n(T,P)]$, where $Q(P,n)$ is the rate of sales, which increases with n.

Thus, $\pi = \pi_a + \pi_s = n(T,P)\, T + (P - \mathrm{MC})\, Q[\mathrm{P}, n(T,P)]$.

For any P, let $T^*(P)$ be the profit-maximizing entry fee, given P. To calculate optimum values for both P **and** T, first chose P, find the optimum T, and then estimate the resulting profit.

Then change P and compute T*(P) again, along with the new profit level.

Repeat until you find a profit-maximizing combination….



This seems complicated. But the following rules of thumb gives a rough idea of what to expect from a two-part tariff:

- Similar demand functions: fix *P* close to MC and make *T* large.
- Different demand functions: fix higher *P* and make *T* smaller.

Examples:

- Parc Astérix has a high entry fee, but usage price is zero.(homogeneous customers).
- Most razor kits are cheap, but then the replacement blades are expensive (heterogeneous customers).

Example.

Cellphone plans are a quintessential example of price discrimination and two-part tariffs.

TABLE 11.3 Cellular Rate Plans (2007)

Anytime Minutes	Monthly Access Fee	Unlimited Nights/ Weekends	Per-Minute Rate After Allowance
A. Verizon: America's Choice Basic			
450	$39.99	Included	$0.45
900	$59.99	Included	$0.40
1350	$79.99	Included	$0.35
2000	$99.99	Included	$0.25
4000	$149.99	Included	$0.25
6000	$199.99	Included	$0.20
B. T-Mobile Individual Plans			
300	$29.99	Unlimited weekends, not weeknights	$0.40
1000	$39.99	Included	$0.40
1500	$59.99	Included	$0.40
2500	$99.99	Included	$0.30
5000	$129.99	Included	$0.30
C. AT&T Individual Plans			
450	$39.99	Includes 5000 minutes	$0.45
900	$59.99	Included	$0.40
1350	$79.99	Included	$0.35
2000	$99.99	Included	$0.25
4000	$149.99	Included	$0.25
6000	$199.99	Included	$0.20

Note: T-Mobile plans do not include any mobile-to-mobile minutes; for T-Mobile these calls are charged from the Anytime Minutes. All other plans include unlimited mobile to mobile minutes.