CHAPTER 12: CAPTURING SURPLUS

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CAPTURING SURPLUS

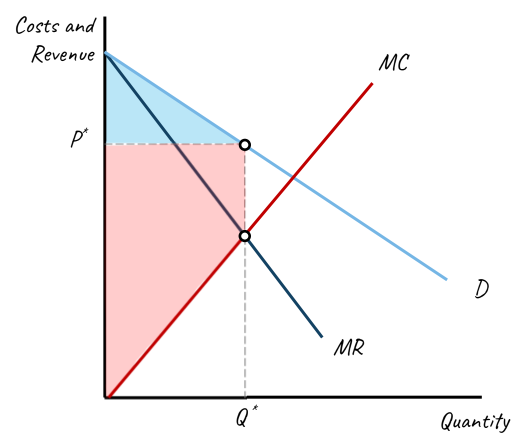
A firm with market power has the potential to capture some additional surplus with appropriate pricing strategies.

Uniform Pricing

Quantity = Q^* and Price = P^*

Consumer Surplus = Blue triangle

Producer Surplus = Red trapezoid



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PRICE DISCRIMINATION

Practice of charging different prices to different consumers for the same good or service.

Three market features necessary for price discrimination

1. A firm must have some market power (demand must be downward sloping.)
2. A firm must have some information about the different amounts people will pay for its products.
3. A firm must be able to prevent resale (no arbitrage)
   - If not, then a consumer who buys at a low price can resell the good to other consumers who are willing to pay more (profit stealing middleman)

FIRST DEGREE PRICE DISCRIMINATION

Ideal situation:

Charge each consumer their $\underbrace{\text{maximum willingness to pay}}_{\text{Reservation Price}}$.

Reservation Price

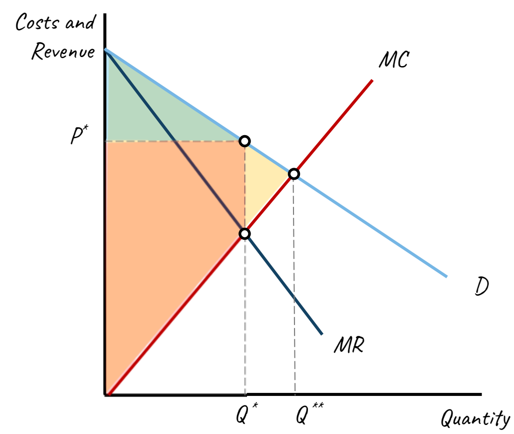
Captured by the height of the demand curve.

PERFECT (first degree) PRICE DISCRIMINATION

Successfully charge each consumer their reservation price

What happens?

1. Consumer surplus disappears!
2. Firm no longer charges a single price.
3. Quantity rises to Q^{**}
4. Producer Surplus increases
5. Deadweight loss disappears



IMPERFECT (first degree) PRICE DISCRIMINATION

In practice, perfect price discrimination is almost never possible.

- Impractical to charge every customer a different price.
- Firms do not know the reservation price of each customer.
- Customer would never reveal their reservation price to the firm!

What happens instead?

Firms discriminate **imperfectly** by charging a few different prices based on estimates of customer's reservations prices.

IMPERFECT PRICE DISCRIMINATION

Examples…

Doctors, lawyers, accountants, architects estimate willingness to pay and set fees accordingly.

Car salesperson can give part of their profit margin away to the customer or can insist that the customer pay the full sticker price.

College or university can tailor the tuition rates with a variety of financial aid packages

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ALGEBRAIC EXAMPLE

Suppose a monopolist has a constant marginal cost of $MC = 2$, no fixed costs, and faces a demand of $P(Q) = 20 - Q$.

1. Find the producer and consumer surplus under uniform pricing.
2. Find the producer surplus under perfect price discrimination.

Step 1: Solve for the profit maximizing Q and P under uniform pricing

$TR(Q) =$

$MR(Q) =$

Set $MC = MR(Q)$ to find Q^*

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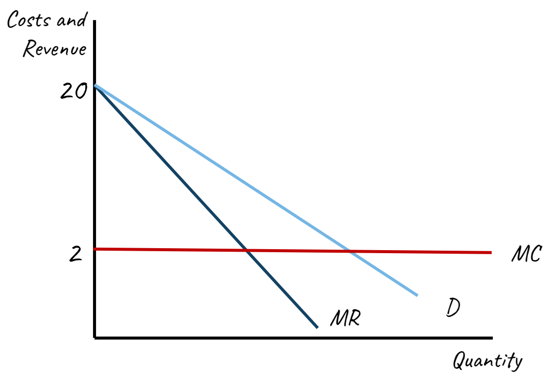
ALGEBRAIC EXAMPLE

Suppose a monopolist has a constant marginal cost of $MC = 2$, no fixed costs, and faces a demand of $P(Q) = 20 - Q$.



Step 1: Solve for the profit maximizing Q and P under uniform pricing

Plug $Q^* = 9$ into demand to find P^*

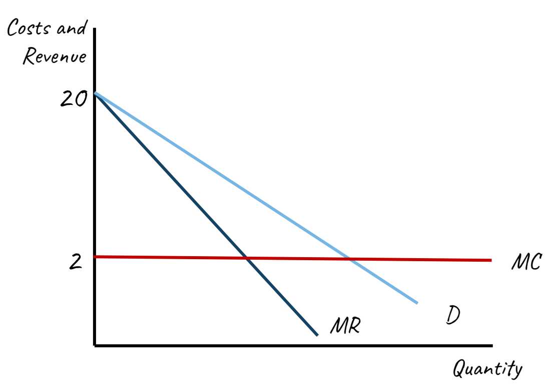
Step 2: Sketch relevant curves

Step 3: Calculate producer surplus.

Step 4: Calculate consumer surplus

ALGEBRAIC EXAMPLE

Suppose a monopolist has a constant marginal cost of $MC = 2$, no fixed costs, and faces a demand of $P(Q) = 20 - Q$.



Step 1: Determine how many units will be sold under perfect price discr.

Step 2: Sketch relevant curves

Step 3: Calculate producer surplus

What about Consumer Surplus??

SECOND DEGREE PRICE DISCRIMINATION

SECOND DEGREE PRICE DISCRIMINATION

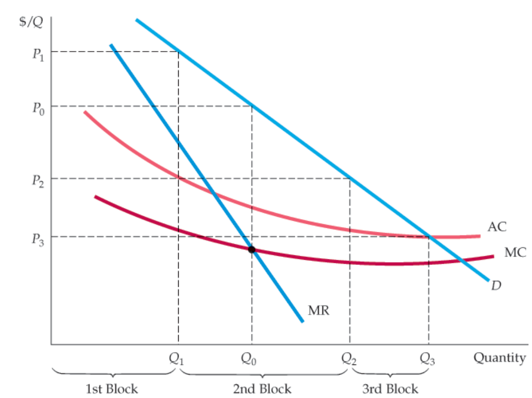
Practice of charging different prices per unit for different quantities of the same good or service.

Occurs in markets where each consumer purchases many units of a good.

As additional units are purchased, the reservation price declines (diminishing MU).

The firm knows this, so they

1. offer quantity discounts or
2. Engage in **block pricing** – charge different prices for different blocks of a good.



BLOCK PRICING EXAMPLE

Consider the market for electricity…

All customers have the same inverse demand curve: $\boldsymbol{P(Q) = 20 - Q}$

The firm's marginal cost is $\boldsymbol{MC = 2}$, and there are no fixed costs

The firm's profit under uniform pricing is $\Pi_u = 81$.

They want to generate more profit!

Plan to achieve this via a **block pricing scheme** where,

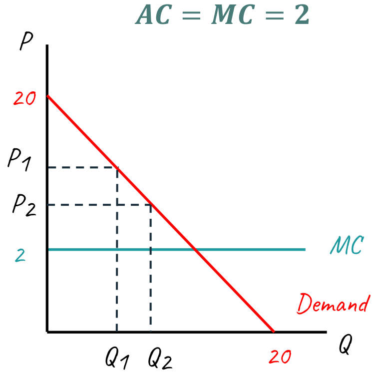
- the first Q_1 units are sold at a price of P_1 and
- any additional units are purchased at a price of P_2

BLOCK PRICING EXAMPLE

Goal: Determine the optimal (profit maximizing) block pricing scheme and the amount of profit earned.

$\boldsymbol{P(Q) = 20 - Q}$

$\boldsymbol{AC = MC = 2}$



Step 1: Write profit as a function of Q_1 and Q_2 only.

$$\Pi_B = Q_1(P_1 - MC) + (Q_2 - Q_1)(P_2 - MC)$$

$$\Pi_B = Q_1(20 - Q_1 - 2) + (Q_2 - Q_1)(20 - Q_2 - 2)$$

$$= Q_1(18 - Q_1) + (Q_2 - Q_1)(18 - Q_2)$$

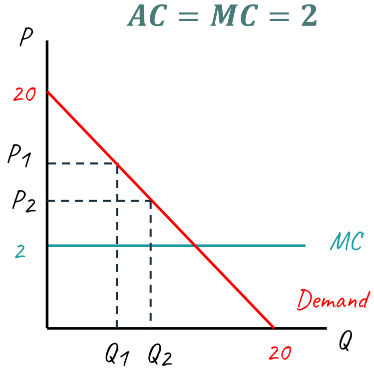
$$= 18Q_2 - Q_2^2 + Q_1Q_2 - Q_1^2$$

BLOCK PRICING EXAMPLE

Goal: Determine the optimal (profit maximizing) block pricing scheme and the amount of profit earned.

$$\boldsymbol{P(Q) = 20 - Q}$$

$$\boldsymbol{AC = MC = 2}$$



Step 2: First order conditions for a maximum

$$\Pi_B = 18Q_2 - Q_2^2 + Q_1Q_2 - Q_1^2$$

(1) $\frac{\partial \Pi_B}{\partial Q_1} =$

(2) $\frac{\partial \Pi_B}{\partial Q_2} =$

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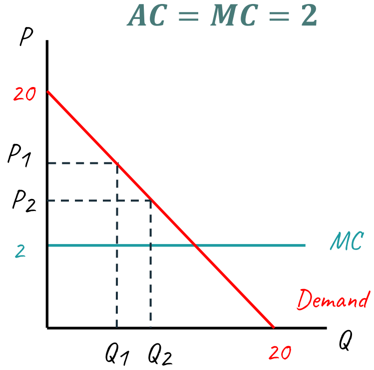
BLOCK PRICING EXAMPLE

Goal: Determine the optimal (profit maximizing) block pricing scheme and the amount of profit earned.

$$\boldsymbol{P(Q) = 20 - Q}$$

$$\boldsymbol{AC = MC = 2}$$



Step 3: Solve for Q_1 and Q_2

(1) $Q_2 - 2Q_1 = 0$

(2) $18 - 2Q_2 + Q_1 = 0$

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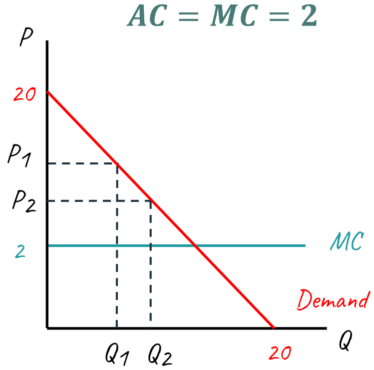
BLOCK PRICING EXAMPLE

Goal: Determine the optimal (profit maximizing) block pricing scheme and the amount of profit earned.

$$P(Q) = 20 - Q$$

$$AC = MC = 2$$



Step 4: Solve for P_1 and P_2

$$Q_1 = 6, \qquad Q_2 = 12$$

$P_1 =$

$P_2 =$

Optimal Block Pricing Scheme

- Sell first 6 units for \$14 each
- Sell the next 6 units for \$8 each

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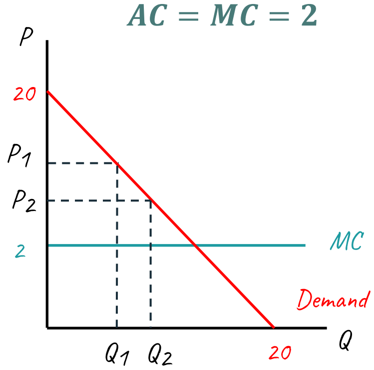
BLOCK PRICING EXAMPLE

Goal: Determine the optimal (profit maximizing) block pricing scheme and the amount of profit earned.

$$P(Q) = 20 - Q$$

$$AC = MC = 2$$



How much **profit** does the firm earn from the profit maximizing block pricing scheme?

$$Q_1 = 6, \qquad Q_2 = 12, \qquad P_1 = \$14, \qquad P_2 = \$8$$

$$\Pi_B = Q_1(P_1 - MC) + (Q_2 - Q_1)(P_2 - MC)$$

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THIRD DEGREE PRICE DISCRIMINATION

THIRD DEGREE PRICE DISCRIMINATION

Practice of dividing consumers into two or more groups with separate demand curves and charging different prices to each group.

Most prevalent form of price discrimination…

Regular vs. special airline rates

Premium vs. nonpremium brands of liquor, canned food, frozen vegetables

Discounts to students or seniors

THIRD DEGREE PRICE DISCRIMINATION

Practice of dividing consumers into two or more groups with separate demand curves and charging different prices to each group.

When is it feasible?

If the firm can create consumer groups based on…

Consumer characteristics

Identify the more price sensitive group and charge them a lower price.

Past purchase behavior

Consumers reveal a lot about their willingness to pay when they make purchases.

Location

The price sensitivity of buyers often varies by location; sellers may charge different prices in different areas.

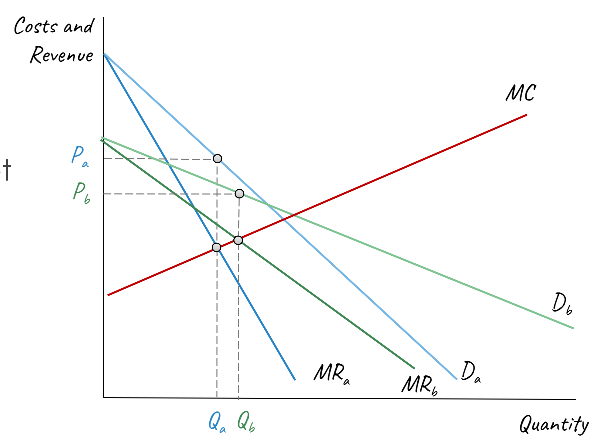
Over time

We'll talk about this later (intertemporal price discrimination)

THE WRONG WAY TO DETERMINE OPTIMAL Q AND P

First instinct is probably…

1. For each segment set $MR_i = MC$, find Q_i^*
2. Plug Q_i^* into inverse demand to find P_i^*



If MC is rising (or falling)…

then the marginal revenue from one market will be higher than from the other…

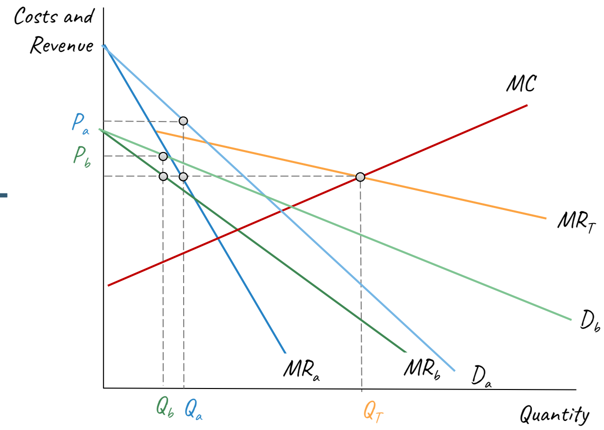
That cannot be optimal!

It must be that

$$MR_a(Q_a) = MR_b(Q_b) = MC(Q_a + Q_b)$$

THE RIGHT WAY TO DETERMINE OPTIMAL Q AND P

1. Form MR_T by horizontally summing the marginal revenue curves
2. The firm produces Q_T, where $MR_T = MC$
3. Divide Q_T between the two markets by setting $MR_a = MR_b = MC$



This model is solved by setting…

$\boldsymbol{MR_a(Q_a) = MR_b(Q_b) = MC(Q_T)}$ **to find** $\boldsymbol{Q_a, Q_b}$ **and** $\boldsymbol{Q_T = Q_a + Q_b}$

Prices are then determined as usual

$$\boldsymbol{P_a = P_a(Q_a), \quad P_b = P_b(Q_b)}$$

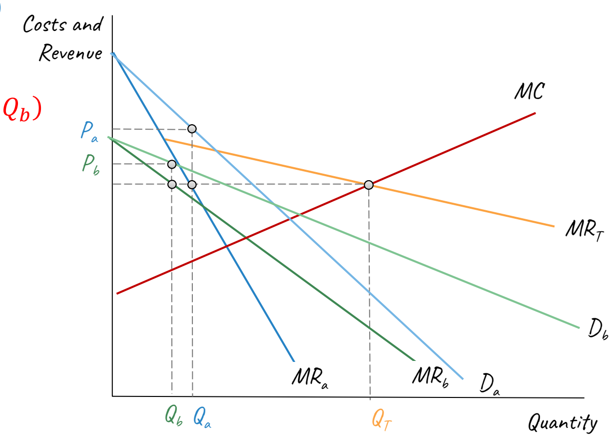
THE RIGHT WAY TO DETERMINE OPTIMAL Q AND P

Where does this condition come from?

$$\boldsymbol{MR_a(Q_a) = MR_b(Q_b) = MC(Q_T)}$$

Profit maximization of course!

$$\pi = Q_a \times P_a(Q_a) + Q_b \times P_b(Q_b) - TC(Q_a + Q_b)$$



First order conditions…

(1) $\frac{\partial \pi}{\partial Q_a} = MR_a(Q_a) - MC(Q_a + Q_b) = 0$

(2) $\frac{\partial \pi}{\partial Q_b} = MR_b(Q_b) - MC(Q_a + Q_b) = 0$

Rearranging these generates the optimality condition.

SOLVING THIRD DEGREE PRICE DISCRIMINATION

$MR_a(Q_a) = MR_b(Q_b) = MC(Q_a + Q_b)$ to find Q_a, Q_b and $Q_T = Q_a + Q_b$

If $MC = C = 10$

Then you can solve each market separately…

$MR_a(Q_a) = 10$ (solve for Q_a)

$MR_b(Q_b) = 10$ (solve for Q_b)

If $MC = f(Q_T) = 10 + Q_T$

Then you solve the following for Q_a and Q_b…

$MR_a(Q_a) = MR_b(Q_b)$

$MR_b(Q_b) = 10 + Q_a + Q_b$

Prices are then determined using the demand curve in both scenarios

$$P_a = P_a(Q_a), \qquad P_b = P_b(Q_b)$$

A THIRD DEGREE PRICE DISCRIMINATION EXAMPLE

Suppose there are two segments of the market served by a monopolist.

Segment A has inverse demand of

$$P_A = 80 - 2Q_A$$

Segment B has inverse demand of

$$P_B = 64 - Q_B$$

The firm has total cost of $TC(Q_T) = 2Q_T^2$ and a marginal cost of $MC_T = 4Q_T$.

First, suppose that **price discrimination is allowed**…

1. Find the firm's profit maximizing Q_A & Q_B, and associated P_A & P_B.
2. Calculate the firm's profit under price discrimination.

A THIRD DEGREE PRICE DISCRIMINATION EXAMPLE

First, suppose that **price discrimination is allowed**…

1. Find the firm's profit maximizing Q_A & Q_B, and associated P_A & P_B.
2. Calculate the firm's profit under price discrimination.

What we know

$$P_A = 80 - 2Q_A, \qquad P_B = 64 - Q_B$$

$$TC(Q_T) = 2Q_T^2, \qquad MC_T = 4Q_T$$

Optimality Condition

$$MR_A(Q_A) = MR_B(Q_B) = MC(Q_A + Q_B)$$

Step 1… Find $MR_A(Q_A)$ and $MR_B(Q_B)$

A THIRD DEGREE PRICE DISCRIMINATION EXAMPLE

First, suppose that **price discrimination is allowed**…

1. Find the firm's profit maximizing Q_A & Q_B, and associated P_A & P_B.
2. Calculate the firm's profit under price discrimination.

What we know

$$P_A = 80 - 2Q_A, \qquad P_B = 64 - Q_B$$

$$TC(Q_T) = 2Q_T^2, \qquad MC_T = 4Q_T$$

Optimality Condition

$$MR_A(Q_A) = MR_B(Q_B) = MC(Q_A + Q_B)$$

Step 2… Apply the optimality condition

(1) $MR_A = MR_B \Rightarrow 80 - 4Q_A = 64 - 2Q_B$

(2) $MR_B = MC \Rightarrow 64 - 2Q_B = 4(Q_A + Q_B)$

Solve (1) for Q_A

A THIRD DEGREE PRICE DISCRIMINATION EXAMPLE

First, suppose that **price discrimination is allowed**…

1. Find the firm's profit maximizing Q_A & Q_B, and associated P_A & P_B.
2. Calculate the firm's profit under price discrimination.

What we know

$$P_A = 80 - 2Q_A, \qquad P_B = 64 - Q_B$$
$$TC(Q_T) = 2Q_T^2, \qquad MC_T = 4Q_T$$

Optimality Condition

$$MR_A(Q_A) = MR_B(Q_B) = MC(Q_A + Q_B)$$

Step 2… Apply the optimality condition

(1) $MR_A = MR_B \Rightarrow 80 - 4Q_A = 64 - 2Q_B$

(2) $MR_B = MC \Rightarrow 64 - 2Q_B = 4(Q_A + Q_B)$

Plug $Q_A = 4 + 0.5Q_B$ into (2) and solve for Q_B

A THIRD DEGREE PRICE DISCRIMINATION EXAMPLE

First, suppose that **price discrimination is allowed**…

1. Find the firm's profit maximizing Q_A & Q_B, and associated P_A & P_B.
2. Calculate the firm's profit under price discrimination.

What we know

$$P_A = 80 - 2Q_A, \qquad P_B = 64 - Q_B$$
$$TC(Q_T) = 2Q_T^2, \qquad MC_T = 4Q_T$$

Optimality Condition

$$MR_A(Q_A) = MR_B(Q_B) = MC(Q_A + Q_B)$$

Step 2… Apply the optimality condition

(1) $MR_A = MR_B \Rightarrow 80 - 4Q_A = 64 - 2Q_B$

(2) $MR_B = MC \Rightarrow 64 - 2Q_B = 4(Q_A + Q_B)$

Plug $Q_B = 6$ into $Q_A = 4 + 0.5Q_B$

A THIRD DEGREE PRICE DISCRIMINATION EXAMPLE

What do we know so far?

$$Q_A = 7$$
$$Q_B = 6$$
$$Q_T = 7 + 6 = 13$$

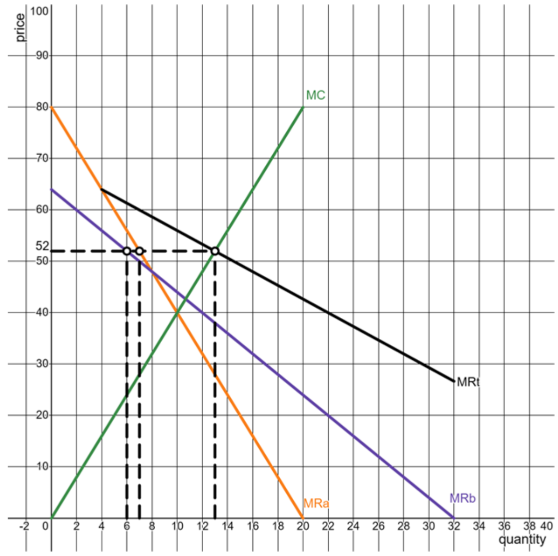
Graphically…

Notice that at this solution…

$MR_A(7)=80-4(7)=\$52$

$MR_B(6)=64-2(6)=\$52$

$MC(13) = 4(13)=\$52$



A THIRD DEGREE PRICE DISCRIMINATION EXAMPLE

First, suppose that **price discrimination is allowed**…

1. Find the firm's profit maximizing Q_A & Q_B, and associated P_A & P_B.
2. Calculate the firm's profit under price discrimination.

What we know

$$P_A = 80 - 2Q_A, \qquad P_B = 64 - Q_B$$
$$TC(Q_T) = 2Q_T^2, \qquad MC_T = 4Q_T$$

Optimality Condition

$$MR_A(Q_A) = MR_B(Q_B) + MC(Q_A + Q_B)$$

Step 3… Use inverse demand to find the two prices.

$$Q_A = 7, \qquad Q_B = 6$$

A THIRD DEGREE PRICE DISCRIMINATION EXAMPLE

First, suppose that **price discrimination is allowed**…

1. Find the firm's profit maximizing Q_A & Q_B, and associated P_A & P_B.
2. Calculate the firm's profit under price discrimination.

What we know

$$P_A = 80 - 2Q_A, \qquad P_B = 64 - Q_B$$

$$TC(Q_T) = 2Q_T^2, \qquad MC_T = 4Q_T$$

Optimality Condition

$$MR_A(Q_A) = MR_B(Q_B) + MC(Q_A + Q_B)$$

$$Q_A = 7, \qquad Q_B = 6$$

$$P_A = \$66, \qquad P_B = \$58$$

$$\Pi(Q_A, Q_B) = Q_A \times P_A + Q_B \times P_B - 2(Q_A + Q_B)^2$$

SOME HOMEWORK ADVICE…

When is profit equal to producer surplus?

When there are no fixed costs

What is the relationship between profit and producer surplus when there are fixed costs?

π = PS - FC

(use this in question 2: part 2 & 4)

When can I use $\pi = Q(P - MC)$ to find profit?

If MC = AC

(this occurs when MC is constant and there are no fixed costs.)

What do I do if that is not true?

π = PQ - TC(Q)

(use this in question 4: part 4)

A THIRD DEGREE PRICE DISCRIMINATION EXAMPLE

Suppose there are two segments of the market served by a monopolist.

Segment A has inverse demand of

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Segment B has inverse demand of

$$P_B = 64 - Q_B$$

The firm has total cost of $TC(Q_T) = 2Q_T^2$ and a marginal cost of $MC_T = 4Q_T$.

Now, suppose that **price discrimination is not allowed**…

1. Find the firm's profit maximizing Q and P.
2. Calculate the firm's profit when price discrimination is not permitted.

This is a monopoly serving multiple markets.

It is covered in chapter 11.

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A MONOPOLY SERVING MULTIPLE MARKETS

Now, suppose that **price discrimination is not allowed**…

1. Find the firm's profit maximizing Q and P.
2. Calculate the firm's profit when price discrimination is not permitted.

What we know

$$P_A = 80 - 2Q_A, \qquad P_B = 64 - Q_B$$

$$TC(Q_T) = 2Q_T^2, \qquad MC_T = 4Q_T$$

Optimality Condition

$$MR_T = MC_T$$

Step 1… Find the market demand curve

Invert and Add (carefully)

$$Q_A = 40 - 0.5P$$
$$Q_B = 64 - P$$

$$\Rightarrow \quad Q_T = 40 - 0.5P + 64 - P$$

$$\underbrace{Q_T = 104 - 1.5P}$$

This is only true if… $P \leq 64$

If $64 < P \leq 80$ … $Q_T = Q_A = 40 - 0.5P$

$$\boxed{Q_T = \begin{cases} 40 - 0.5P & if\ 64 \leq P < 80 \\ 104 - 1.5P & if\ 0 \leq P < 64 \end{cases}}$$

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A MONOPOLY SERVING MULTIPLE MARKETS

Now, suppose that **price discrimination is not allowed**…

1. Find the firm's profit maximizing Q and P.
2. Calculate the firm's profit when price discrimination is not permitted.

What we know

$$P_A = 80 - 2Q_A, \qquad P_B = 64 - Q_B$$

$$TC(Q_T) = 2Q_T^2, \qquad MC_T = 4Q_T$$

Optimality Condition

$$MR_T = MC_T$$

$$Q_T = \begin{cases} 40 - 0.5P & if\ 64 \le P < 80 \\ 104 - 1.5P & if\ 0 \le P < 64 \end{cases}$$

Step 2… Assume that $P < 64$ and apply the optimality condition.

Invert demand

A MONOPOLY SERVING MULTIPLE MARKETS

Now, suppose that **price discrimination is not allowed**…

1. Find the firm's profit maximizing Q and P.
2. Calculate the firm's profit when price discrimination is not permitted.

What we know

$$P_A = 80 - 2Q_A, \qquad P_B = 64 - Q_B$$

$$TC(Q_T) = 2Q_T^2, \qquad MC_T = 4Q_T$$

Optimality Condition

$$MR_T = MC_T$$

$$Q_T = \begin{cases} 40 - 0.5P & if\ 64 \le P < 80 \\ 104 - 1.5P & if\ 0 \le P < 64 \end{cases}$$

Step 2… Assume that $P < 64$ and apply the optimality condition.

Find Marginal Revenue

$$P = \frac{208}{3} - \frac{2Q_T}{3}$$

A MONOPOLY SERVING MULTIPLE MARKETS

Now, suppose that **price discrimination is not allowed**…

1. Find the firm's profit maximizing Q and P.
2. Calculate the firm's profit when price discrimination is not permitted.

What we know

$$P_A = 80 - 2Q_A, \qquad P_B = 64 - Q_B$$

$$TC(Q_T) = 2Q_T^2, \qquad MC_T = 4Q_T$$

Optimality Condition

$$MR_T = MC_T$$

$$Q_T = \begin{cases} 40 - 0.5P & if\ 64 \le P < 80 \\ 104 - 1.5P & if\ 0 \le P < 64 \end{cases}$$

Step 2… Assume that $P < 64$ and apply the optimality condition.

Set $MR_T = MC_T$ and solve for Q_T

$$\frac{208}{3} - \frac{4}{3}Q_T = 4Q_T$$

A MONOPOLY SERVING MULTIPLE MARKETS

Now, suppose that **price discrimination is not allowed**…

1. Find the firm's profit maximizing Q and P.
2. Calculate the firm's profit when price discrimination is not permitted.

What we know

$$P_A = 80 - 2Q_A, \qquad P_B = 64 - Q_B$$

$$TC(Q_T) = 2Q_T^2, \qquad MC_T = 4Q_T$$

Optimality Condition

$$MR_T = MC_T$$

$$Q_T = \begin{cases} 40 - 0.5P & if\ 64 \le P < 80 \\ 104 - 1.5P & if\ 0 \le P < 64 \end{cases}$$

Step 2… Assume that $P < 64$ and apply the optimality condition.

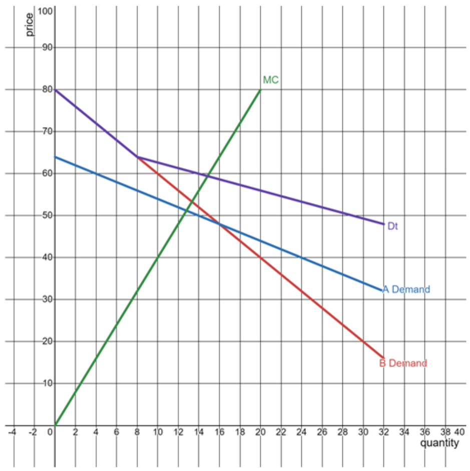
Find price using inverse demand

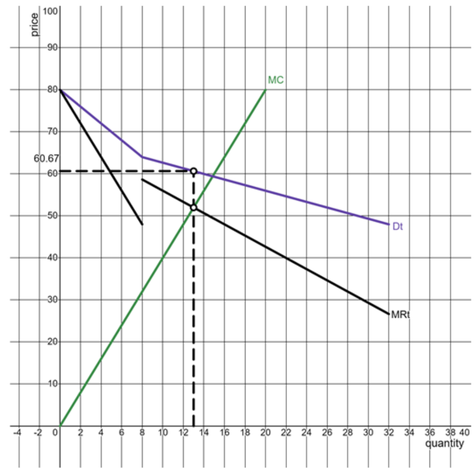
$$Q_T = 13$$

$$P = \frac{208}{3} - \frac{2Q_T}{3}$$

A MONOPOLY SERVING MULTIPLE MARKETS

Step 3… Graph it to better understand!





A MONOPOLY SERVING MULTIPLE MARKETS

Now, suppose that **price discrimination is not allowed**…

1. Find the firm's profit maximizing Q and P.
2. Calculate the firm's profit when price discrimination is not permitted.

What we know

$$P_A = 80 - 2Q_A, \qquad P_B = 64 - Q_B$$

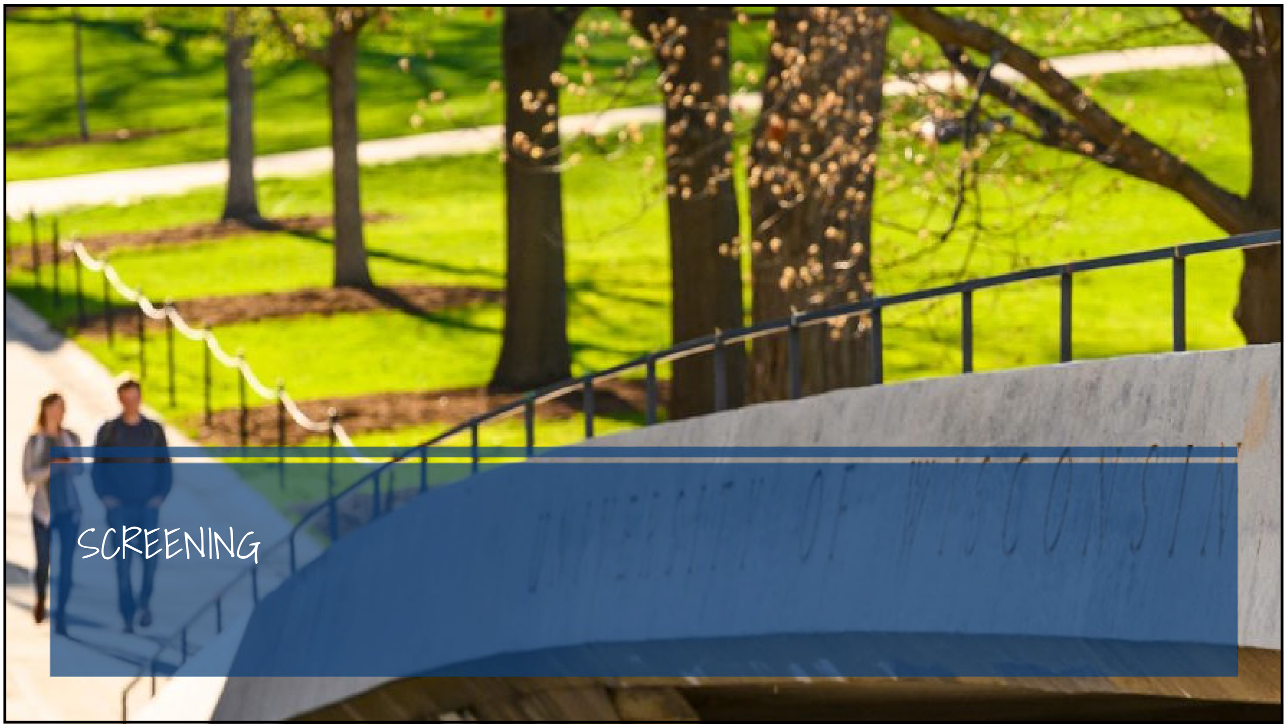
$$TC(Q_T) = 2Q_T^2, \qquad MC_T = 4Q_T$$

Optimality Condition

$$MR_T = MC_T$$

$$Q_T = 13, \qquad P_T = \$60.67$$

$$\Pi(Q_T, P_T) = Q_T \times P_T - 2Q_T^2$$



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SCREENING

Broad term that captures the various methods sellers use to induce consumers to reveal their willingness to pay.

A firm would like to charge…

- a high price to consumers with a high willingness to pay or a low price elasticity of demand
- a low price to consumers with a low willingness to pay or a high price elasticity of demand

Problem…these characteristics are not observable.

By asking for id before selling at a discount, firms can prevent arbitrage.

One work around…

Find an observable consumer **characteristic** that is correlated with willingness to pay or elasticity of demand.

Use that **characteristic** to charge the appropriate price.

Examples:

1. Student discounts
2. Senior citizen discounts
3. Occupation based discounts (miliary or education)

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SCREENING

Broad term that captures the various methods sellers use to induce consumers to reveal their willingness to pay.

A firm would like to charge…

- a high price to consumers with a high willingness to pay or a low price elasticity of demand
- a low price to consumers with a low willingness to pay or a high price elasticity of demand

Problem…these characteristics are not observable.

Another work around…

Find an observable consumer **behavior** that is correlated with willingness to pay or elasticity of demand.

Use that **behavior** to charge the appropriate price.

Examples:

1. Willingness to wait to purchase a good
2. Willingness to clip coupons
3. Willingness to join a membership program
4. Purchase time of day or week

INTERTEMPORAL PRICE DISCRIMINATION

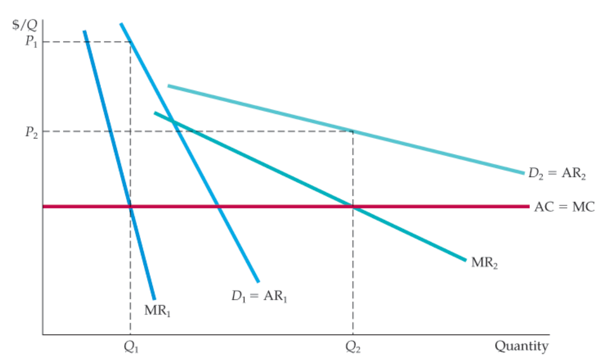
Practice of separating consumers with different demand functions into different groups by charging different prices at different points in time.

Charge a high price initially…

- Sell to all the high-demand consumers

Let price fall after some time passes

- Sell to all the low-demand consumers



Examples:

1. Technology
2. Movies
3. Books

COUPONS AND REBATES

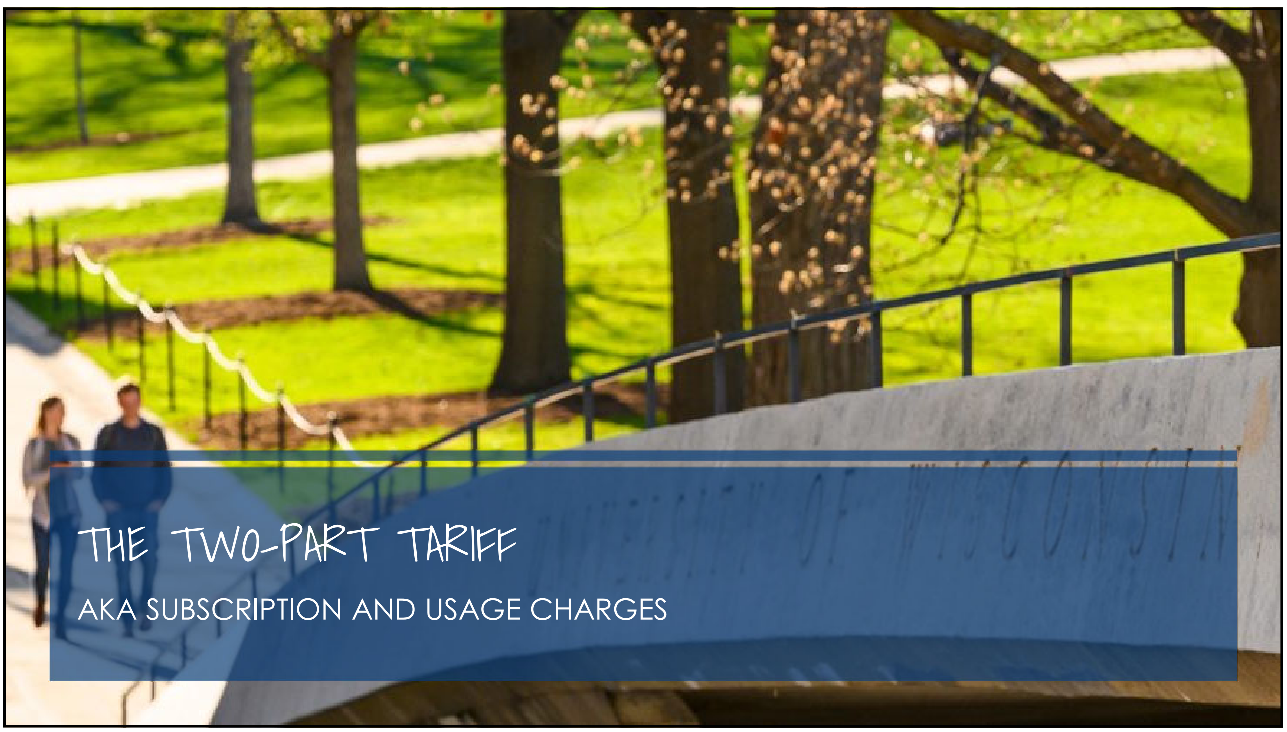
Stores and brands often offer coupons on new products, food products, pet food, etc…

Why?

Its just a different way of screening out those with lower willingness to pay or higher price elasticity of demand!

Those who take the time to collect and redeem coupons or fill out and collect rebates must be more price sensitive than those who do not.

(Price discrimination is not the only reason to offer coupons)



THE TWO-PART TARIFF

AKA SUBSCRIPTION AND USAGE CHARGES

THE TWO-PART TARIFF

Form of pricing in which consumers are charged both an entry (access) fee and a usage fee.

This is another means of extracting consumer surplus…

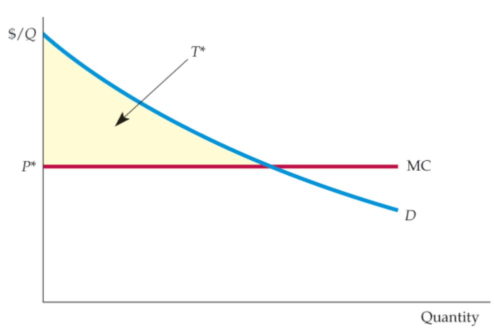
Examples

1. Tennis and golf clubs
2. Rental of large mainframe computers
3. Telephone service
4. Amusement parks
5. Sam's club or similar stores

THE BASICS…

T = entry fee, P = usage fee

Single Consumer



Set $P = MC$ and $T = CS$

THE BASICS…

$T =$ entry fee, $P =$ usage fee

If firm sets $P = MC$, then entry fee is limited to the CS of the low demand consumer.

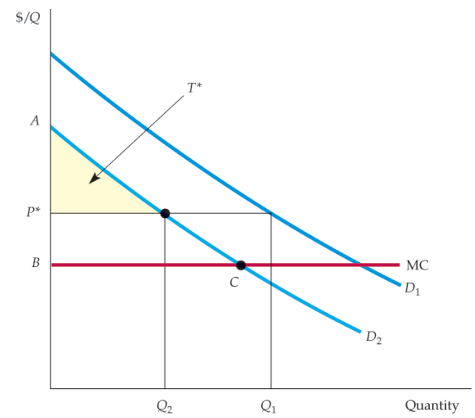
This would not yield maximum profit.

Firm should set $P^* > MC$ and $T^* = CS_2$

Ultimately, the firm's goal is to maximize their profit:

$$\pi = 2T^* + (P^* - MC)(Q_1 + Q_2)$$

Two Consumers



MANY CONSUMERS

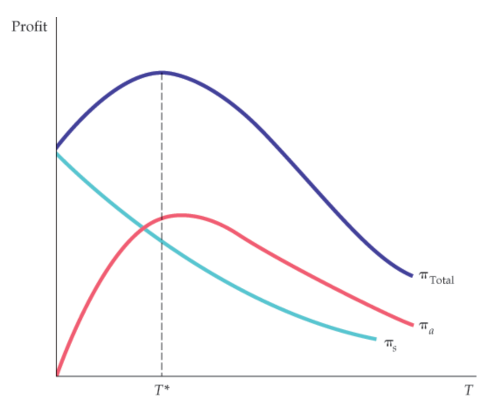
No simple formula to calculate the optimal two-part tariff when there are many types of consumers…

Tradeoff

1. A low entry fee means more entrants and thus more profit from sales of the item.
2. As the entry fee becomes smaller, profit from the entry fee will fall.

We could solve the problem iteratively

- Pick a P
- Find the optimal T
- Calculate profit…



A TWO-PART TARIFF EXAMPLE

Suppose that Double U, a local bar, charges a nightly entry fee, E, and a separate price for each drink consumed, P.

On any given evening Double U has two types of potential customers of equal number…

100 students and 100 non-students.

Each student has inverse demand of

$$P_s(Q) = 16 - 2Q_s$$

Each non-student has inverse demand of

$$P_n(Q) = 20 - 2Q_n$$

P is the price per drink in dollars and Q is the number of drinks consumed.

Double U's marginal cost for a drink is $4 and they have no fixed costs.

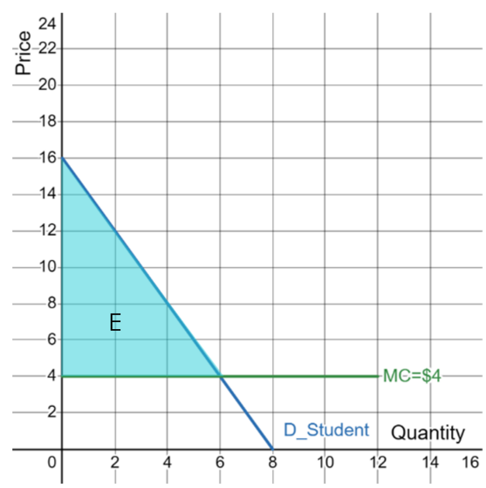
A TWO-PART TARIFF EXAMPLE

Suppose that Double U is able to separate student and non-student customers.

1. What entry fee and price should they charge each group?
2. What would be their total profits?

Students…

$$P_s(Q) = 16 - 2Q_s$$
$$MC = \$4$$



A TWO-PART TARIFF EXAMPLE

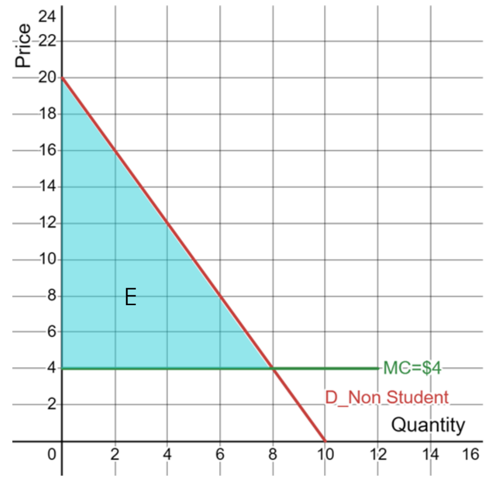
Suppose that Double U is able to separate student and non-student customers.

1. What entry fee and price should they charge each group?
2. What would be their total profits?

Non-students…

$$P_n(Q) = 20 - 2Q_n$$

$$MC = \$4$$



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A TWO-PART TARIFF EXAMPLE

Suppose that Double U is able to separate student and non-student customers.

1. What entry fee and price should they charge each group?
2. What would be their total profits?

Note… the price per drink just covers Double U's costs, so the entry fee is all profit!

100 Students

$$P_s = \$4$$

$$E_s = 36$$

100 Non-students…

$$P_n = \$4$$

$$E_n = 64$$

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A TWO-PART TARIFF EXAMPLE

Suppose that Double U is **not able to separate** student and non-student customers.

As a result, they must establish one two-part tariff—that is, they set one entry fee and one price that both students and non-students pay.

1. What entry fee and price should they charge?
2. What would be their total profits?

How do we approach this question?

The goal is to solve for the profit maximizing P^* (per drink price).

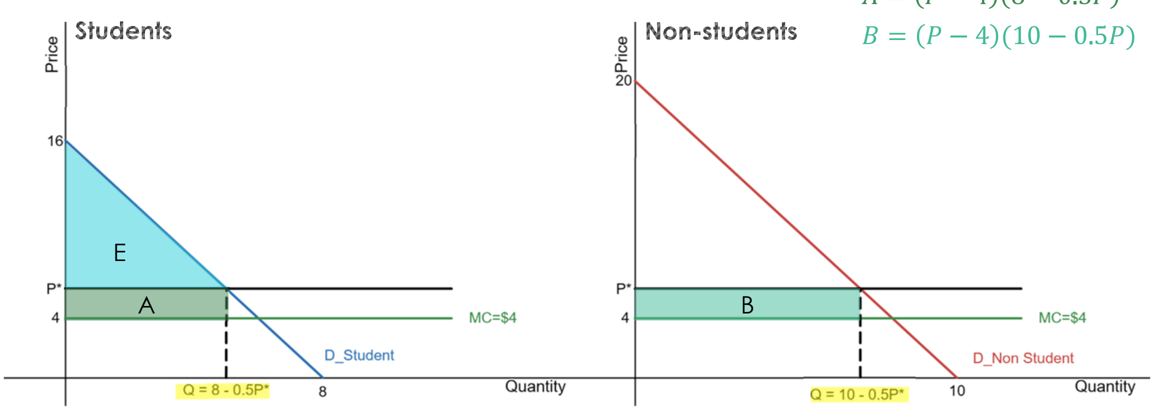
But we need to account for how P^* impacts the size of the entry fee, E

A TWO-PART TARIFF EXAMPLE

$$E = \frac{1}{2}(16 - P)(8 - 0.5P)$$

$$A = (P - 4)(8 - 0.5P)$$

$$B = (P - 4)(10 - 0.5P)$$



$$\Pi = 200 \times E + 100 \times A + 100 \times B$$

Profit per non-student from drink sales

Entry fee

Profit per student from drink sales

A TWO-PART TARIFF EXAMPLE

$\Pi = 200 \times E + 100 \times A + 100 \times B$

$E = \frac{1}{2}(16 - P)(8 - 0.5P)$

$A = (P - 4)(8 - 0.5P)$

$B = (P - 4)(10 - 0.5P)$

$$\pi = 200 \times \frac{1}{2}(16 - P)(8 - 0.5P) + 100(P - 4)(8 - 0.5P) + 100(P - 4)(10 - 0.5P)$$

$$\pi = 100(16 - P)(8 - 0.5P) + 100(P - 4)(18 - P)$$

$$\pi = 100[128 - 8P - 8P + 0.5P^2 + 18P - 72 - P^2 + 4P]$$

$$\pi = 100[56 + 6P - 0.5P^2]$$

A TWO-PART TARIFF EXAMPLE

$\Pi = 200 \times E + 100 \times A + 100 \times B$

$E = \frac{1}{2}(16 - P)(8 - 0.5P)$

$A = (P - 4)(8 - 0.5P)$

$B = (P - 4)(10 - 0.5P)$

The goal is to maximize

$\Pi = 5600 + 600P - 50P^2$

A TWO-PART TARIFF EXAMPLE

Suppose that Double U is **not able to separate** student and non-student customers.

As a result, they must establish one two-part tariff—that is, they set one entry fee and one price that both students and non-students pay.

1. What entry fee and price should they charge?
2. What would be their total profits?

$P^* = 6$
$E^* = \$25$

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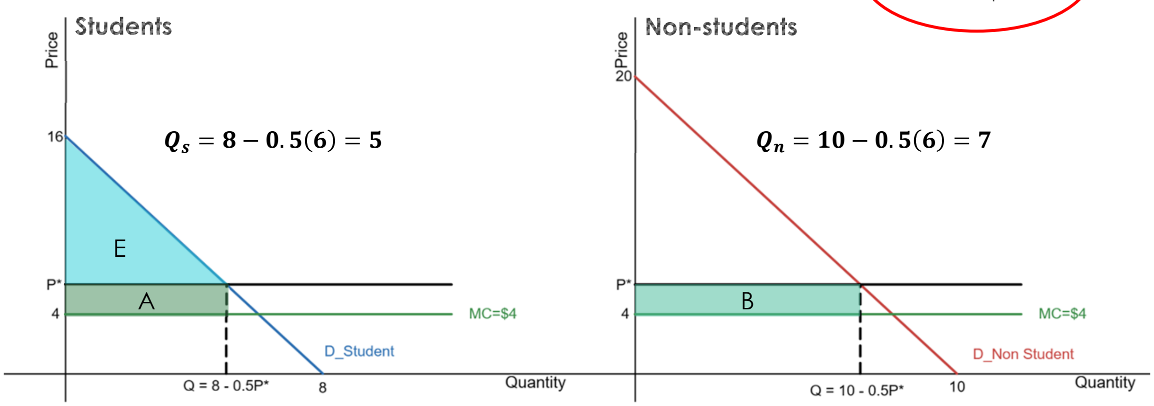
A TWO-PART TARIFF EXAMPLE

$P^* = 6$
$E^* = \$25$



$\Pi = 200 \times E + 100 \times A + 100 \times B \;\; \Rightarrow \Pi = 200 \times 25 + 100 \times (6-4) \times 5 + 100 \times (6-4) \times 7$

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