Price Discrimination, Bundling, and Tying

Reference: Pepall, Richards, and Norman, chapters 5, 6, 8.2

Introduction

- Price data for UA Flight 815 from Chicago-LA, Oct. 15, 1997
- Why is there such variation in prices?
  - Quality differences (First class vs. economy seating)
  - Airlines use time of purchase to infer willingness to pay

Ticket Price	Number of Passengers	Average Advance Purchase (days)
$2,000 or more	18	12
$1,000 - $1,999	15	14
$800 - $999	23	32
$600 - $799	49	46
$400 - $599	23	65
$200 - $399	23	35
Less than $199	34	26
0	19	-


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2nd Buy at $4.20
Pantene
Shampoo Assorted
670ml
UP $10.90 / $12 each
Buy 1 Get 1 Free
Garnier
Olia Hair Color
Assorted
1 Box
UP $19.90 each
$69.90
Cetaphil
Gentle Skin Cleanser
3 x 1 Litre
UP $116.70
$42.90
Physiogel
Cream
3 x 75ml
UP $70.05
2 for $14.20
Listerine
Mouthwash (Cool Mint / Citrus / Original)
1 Litre
UP $8.90 each
$19.80
Complete
Easy Rub Multi Purpose Solution
2 x 360ml + 120ml + 2 x 60ml
1 Set
UP $24
$46.30
Mega Red
Krill Oil Extra Strength 500mg
60s
UP $92.60
$39.90
Guardian
Kube Blood Pressure Monitor
1s
UP $81.20
Star Buy
SAVE $2.50
$67.40
GAIN IQ KID
With Intelli Pro
1.8kg
UP $69.90
3 Days Only
26 - 28 SEPTEMBER 2014
FREE Guardian 2-Step Beauty Mask worth $1.95 with minimum spend of $42 in a single receipt.
While stocks last.
Weekend Specials
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Up to 10% rebate + 10% off house brands

Introduction

- **Price discrimination**
  - Charging different prices to different consumers for the same product
  - Charging a consumer a price which varies with the quantity bought
- Examples
  - Movie or museum tickets sold at **discounted prices** for students and senior citizens
    - Singapore Flyer: $33.00 for an adult, $24.00 for a senior citizen
  - coupons
  - prescription drugs and movie DVDs are cheaper in some countries than others
- **But not all price differences reflect price discrimination** → e.g., there may be cost differentials to supplying a product to different groups of consumers

Starbucks: price discrimination?

Brewed Coffee
Tall: 0.01/ml
Grande: .009/ml
Venti: .008/ml

Fixed cost but when divided when the amount it is smaller.

Introduction

- Why is price discrimination profitable?
  - Because **consumers have different valuations/willingnesses to pay** ➔ firms try to charge consumers with higher valuations a higher price

- Conditions necessary for price discrimination
  - the firm must have some market power (able to set **p > mc**)
  - the firm must be able to distinguish consumers on the basis of their WTP
  - the firm must be able to **prevent resale** from consumers who pay a lower price to consumers who are willing to pay a higher price
    - Canada to US drug resales

Introduction

There are three classifications of price discrimination:

- **First-degree** price discrimination (personalized pricing): the firm is able to charge the maximum each consumer is willing to pay

- **Second-degree** price discrimination (menu pricing): the price per unit depends on the number of units purchased

  the firm cannot observe the WTP, self select pricing

- **Third-degree** price discrimination (group pricing): consumers are grouped with each group having its own price

Introduction

Examples of how price discrimination is implemented:

- **two-part tariff**: the firm charges a lump-sum fee and a per unit price
  - ex. amusement parks (Disneyland pricing)
    Personal seat license in NFL: fans pay a fee of $250 to $4000 for the right to buy season tixs
- **quantity discounts**: a discount for larger purchases
  - ex. 2-for-1 schemes, 12-pack of Coke Light vs. 1 can ($0.78 vs. $1 per can at NTUC Fairprice)
- **tie-in-sales**: the consumer can buy one product only if another product is also purchased
  - ex. razor and razor blades Polaroid cameras

Third-degree Price Discrimination

- Consumers can be grouped by some easily observable characteristic that serves as a good proxy for WTP
  - students and senior citizens
- A uniform price is charged to all consumers of a particular group
- Different uniform prices are charged to different groups ➔ **group pricing**
  - This is the simplest pricing scheme. Others are possible.
- Examples:
  - early-bird specials and happy hours
  - airline tickets: day ticket is purchased, whether there is a weekend layover, etc.

Third-degree Price Discrimination

- The pricing rule is:
  - Consumers with a **low elasticity of demand** are charged a **high price** and consumers with a **high elasticity of demand** are charged a **low price**
- Recall that the relationship between MR and elasticity: $MR_i = p_i\left(1+\frac{1}{\varepsilon_i}\right)$
- Output is allocated such that MR is equalized across markets (and equal to MC)
- With two markets and constant MC:

$$p_1\left(1+\frac{1}{\varepsilon_1}\right) = p_2\left(1+\frac{1}{\varepsilon_2}\right) = MC \Rightarrow p_i = MC \Big/ \left(1+\frac{1}{\varepsilon_i}\right)$$

with two different price elasticities

➢ Price will be higher in the market with the more inelastic/less elastic demand
  - ex. ε_1 = -5, ε_2 = -2 ➔ p_1 = 1.25MC, p_2 = 2MC

Third-degree Price Discrimination

- Ex: Harry Potter and the Deathly Hallows book
- Inverse demand in US: $\mathbf{p_U = 36 - 4Q_U}$, in Europe: $\mathbf{p_E = 24 - 4Q_E}$, **MC = 4**
- Suppose initially that the publisher treats the two markets as a single, integrated market ➔ the same price is charged in the US and Europe
- Invert to find demand:

$$p_U = 36 - 4Q_U \;\rightarrow\; Q_U = 9 - \frac{1}{4} p_U \;\text{ for } p_U \leq 36$$

$$p_E = 24 - 4Q_E \;\rightarrow\; Q_E = 6 - \frac{1}{4} p_E \;\text{ for } p_E \leq 24$$

Third-degree Price Discrimination

- Denote $\mathbf{p = p_U = p_E}$. Aggregate demand:

$$Q = Q_U + Q_E = 9 - \frac{1}{4}p \quad \text{for } 24 \le p \le 36$$

$$Q = Q_U + Q_E = 15 - \frac{1}{2}p \quad \text{for } p < 24$$

At these prices only the US market is active

Qe=0

Both markets are active

- Invert the direct demands:

$$Q = 9 - \frac{1}{4}p_U \quad \text{for } 24 \le p_U \le 36$$

$$\rightarrow \; p = 36 - 4Q \quad \text{for } Q \le 3$$

Kinked point at $24

$$Q = 15 - \frac{1}{2}p_U \quad \text{for } p_U \le 24$$

$$\rightarrow \; p = 30 - 2Q \quad \text{for } 3 \le Q \le 15$$

Third-degree Price Discrimination

- Marginal revenue:

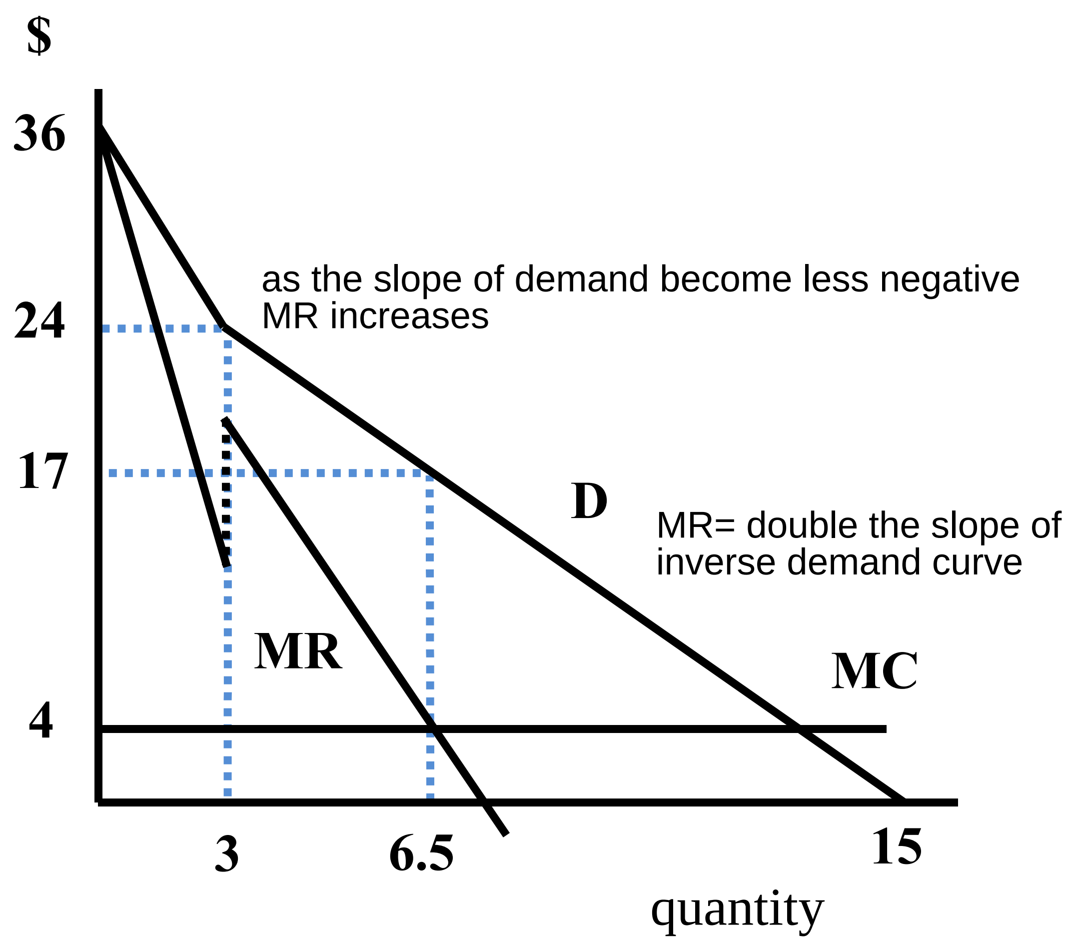
$$MR = 36 - 8Q \quad \text{for } Q \le 3$$

$$MR = 30 - 4Q \quad \text{for } 3 < Q \le 15$$

- Profit maximization:

$$MR = MC \;\rightarrow\; 30 - 4Q = 4$$

$$\rightarrow\; Q^* = 6.5,\, p^* = 17$$



Third-degree Price Discrimination

- Substitute the price into the individual demand functions:

$$Q_U = 9 - \frac{1}{4}p = 9 - \frac{1}{4} \times 17 = 4.75 \text{ million}$$

$$Q_E = 6 - \frac{1}{4}p = 6 - \frac{1}{4} \times 17 = 1.75 \text{ million}$$

- Aggregate profit:

$$\pi = (p - c)Q = (17 - 4)6.5 = \$84.5 \text{ million}$$

Third-degree Price Discrimination

Assumption: Separate markets

- But the firm can do better than this. Notice that MR is not equal to MC in either market ➔ MR = 10 > MC in Europe and MR = -2 < MC in the US
  - The firm is selling too many books in the US and too few in Europe
  - If you take one of the books sold in the US and sell it in Europe instead, revenue and profit would increase by \$12
  - Now suppose that the publisher sets a different price in each market

$$\pi = p_1 q_1 + p_2 q_2 - c(q_1 + q_2) \rightarrow MR_1 = c, MR_2 = c$$

Profit function

assumes that the cost remains constant

Third-degree Price Discrimination

- From the US market:

$$\mathbf{MR = MC \Rightarrow 36 - 8Q_U = 4 \Rightarrow Q_U^* = 4,\ p_U^* = \$20}$$

- From the European market:

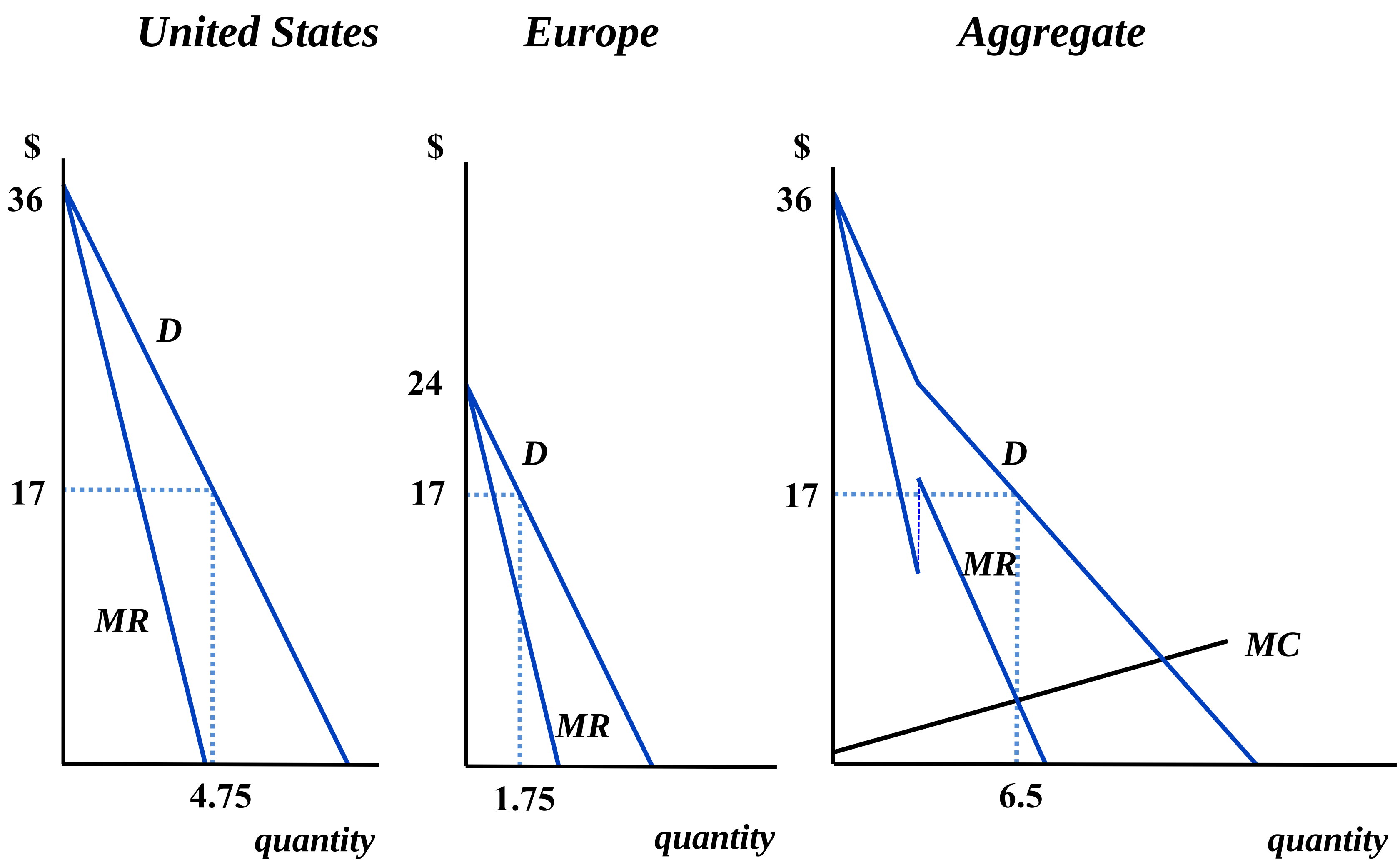
$$\mathbf{MR = MC \Rightarrow 24 - 8Q_E = 4 \Rightarrow Q_E^* = 2.5,\ p_E^* = \$14}$$

- Aggregate sales are 6.5 million books, the same as under uniform pricing
  the fact the quantity sold is the same is a coincidence
- Profit: $\boldsymbol{\pi = \pi_U + \pi_E = 20x4 + 14x2.5 - 6.5x4 = \$89}$ **million**
  - Profit is **$4.5 million** greater than under no price discrimination

Third-degree Price Discrimination

- What if MC was not constant but increasing?
  - **$MC = 0.75 + Q/2$**
- **No price discrimination.** Apply these steps to find the equilibrium:
  - Calculate aggregate demand as done previously
  - Calculate MR ➔ **$MR = 30 – 4Q$** if both markets are served
  - **$MR = MC$ ➔ $30 – 4Q = 0.75 + Q/2$ ➔ $Q^* = 6.5$**
  - Find price from aggregate demand ➔ **$p = 30 – 2Q$ ➔ $p^* = 17$**
  - Units sold: **$Q_U^* = 9 – 17/4 = 4.75$, $Q_E^* = 6 – 17/4 = 1.75$**

Third-degree Price Discrimination



Third-degree Price Discrimination

- Suppose the publisher instead price discriminates
  - How much should be produced in total and how should the output be distributed across the two markets?
- The firm’s decision is always to find quantity such that MR = MC but now it must think in the aggregate since the cost function depends on aggregate output
- Profit maximization: If the maximum MR from selling a book is greater than the MC, the firm should sell another book
  - $\max(MR_{\mathbf{E}}, MR_{\mathbf{US}}) > MC$ then sell another book
- Following this rule results in MR that is the same across markets (when demand is continuous)

Third-degree Price Discrimination

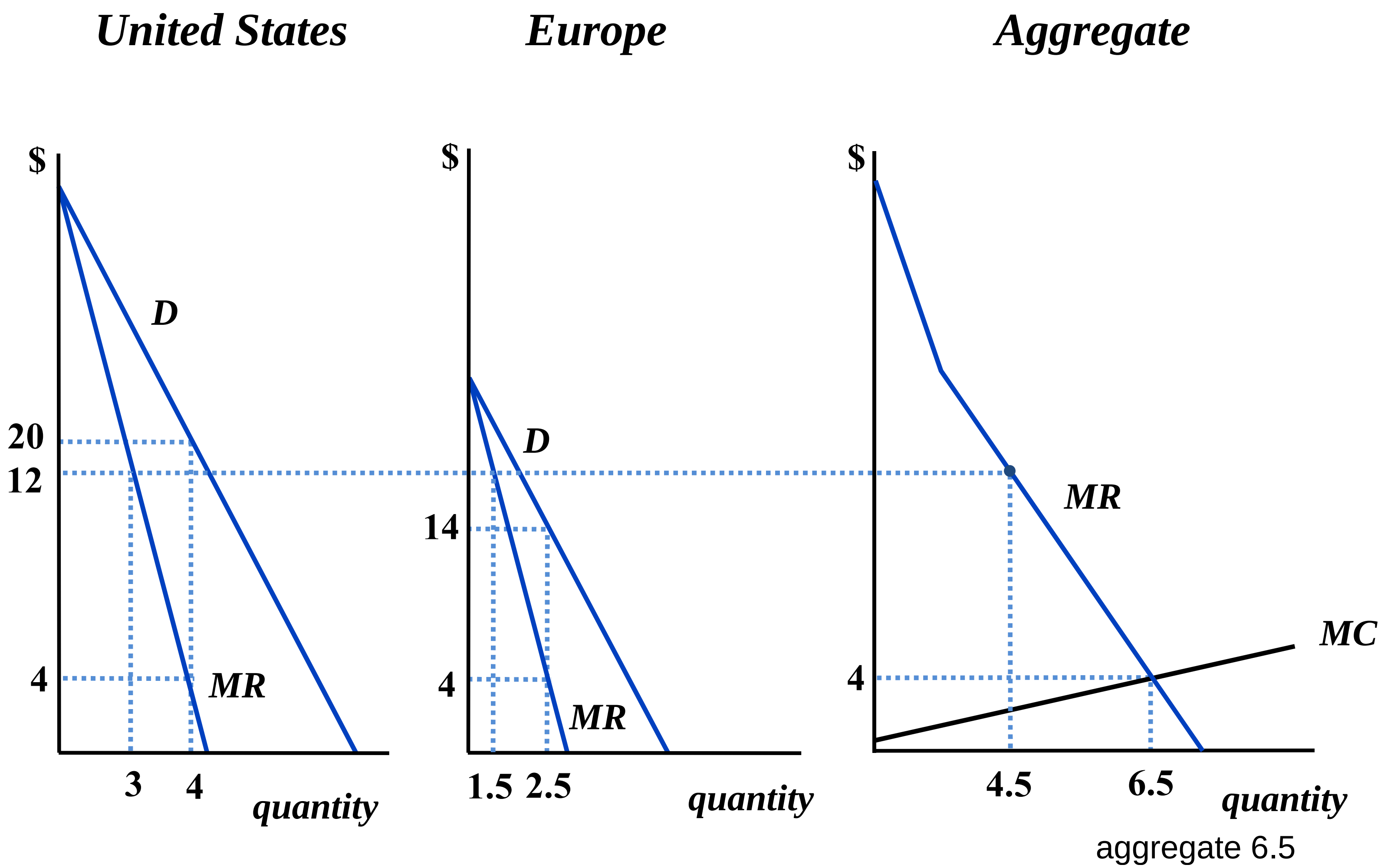
- Numerical (discrete) example

Unit	MR_1	MR_2
1	15	11
2	13	9
3	9	7
4	8	5
5	2	3
6	1	1

Unit	MR	MC	
1	15	1	
2	13	3	
3	11	5	
4	9	8	
5	9	9	Stop here where MR=MC
6	8	12	

- Sell three units in market 1, sell two units in market 2, $\mathbf{MR_1 = MR_2}$
- **Generally: derive *aggregate* MR and set it equal to MC**
  - **For a given MR, how many units are sold in aggregate?**

Third-degree Price Discrimination



Third-degree Price Discrimination

- Mathematically…
- Derive the **MR** in each market, invert and add (*horizontally*)
  - **MR = 36 – 8Q_U** and **MR = 24 – 8Q_E** ➔ invert ➔ **Q_U = 4.5 – MR/8** and **Q_E = 3 – MR/8** ➔ sum and then invert again:

$$Q = Q_U = 4.5 - MR/8 \text{ for } 24 < MR \leq 36$$

$$\rightarrow MR = 36 - 8Q \text{ for } Q < 1.5$$

upper part of MR

$$Q = Q_U + Q_E = 7.5 - MR/4 \text{ for } MR \leq 24$$

$$\rightarrow MR = 30 - 4Q \text{ for } Q \geq 1.5$$

lower part of MR

Third-degree Price Discrimination

- **MR = MC → $30 - 4Q = 0.75 + Q/2$ → $Q^* = 6.5$, MR = 4**
- Find quantities by equating each market's MR to 4:
  - $36 - 8Q_U = 4$ → $Q_U^* = 4$, $24 - 8Q_E = 4$ → $Q_E^* = 2.5$
- Find prices from each market's demand curve:
  - $p_U^* = 36 - 4Q_U^* = 36 - 4 \times 4 = 20$, $p_E^* = 24 - 4Q_E^* = 24 - 4 \times 2.5 = 14$