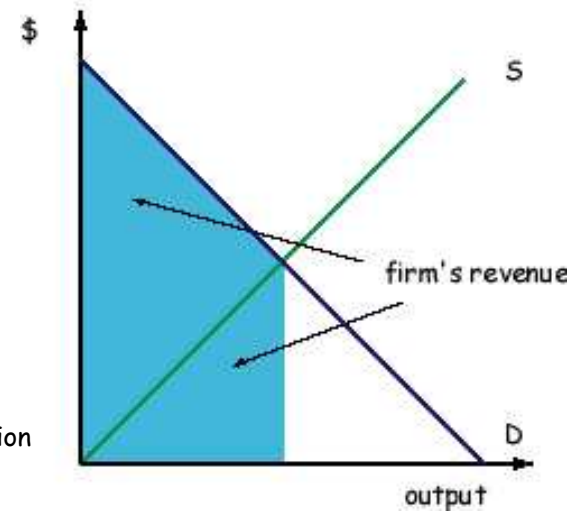
Dynamic Pricing and e-commerce



First degree price discrimination

1. Introduction

Uniform market price: in perfect competition

Dynamic Pricing: under imperfect competition

- non-uniform price
- Price discrimination (PD)
- Market segmentation
- IT and the Internet allows dynamic pricing

1. Introduction

Amazon.com

0.6M customers for particular book

- 0.1M are high WTP = $50
- 0.5M are low WTP = $10

Three Pricing strategies

- (i) Charge P = $10
- (ii) Charge P = $50
- (iii) Discriminate: high WTP $50, low WTP $10

Revenue in

- (i) = $10 * 0.6M = $6M
- (ii) = $50 * 0.1M = $5M
- (iii) = $10 * 0.5M + $50 * 0.1M = $10M

Road map

Theory of PD

IT and the Internet

Amazon.com and PD

Versioning information goods: 3rd degree PD

Goldilocks pricing

Welfare and Policy

2. Theory of PD

Selling units of output to different customers at different prices

(i) Fairness and customer protection

(ii) 1st degree PD: perfect PD, personalized pricing

(iii) 2nd degree PD: price-quantity package

(iv) 3rd degree PD: group pricing, versioning

(v) Competition

(vi) Summary

2. Theory of PD

(i) Fairness and Consumer protection

Robinson-Patman Act (Anti-chain-store Act) 1936

PD is not illegal in US

- Unless it lessens competition
- Price difference due to production and delivery costs

PD improves W

2. Theory of PD - 1st degree PD

(ii) 1st degree PD

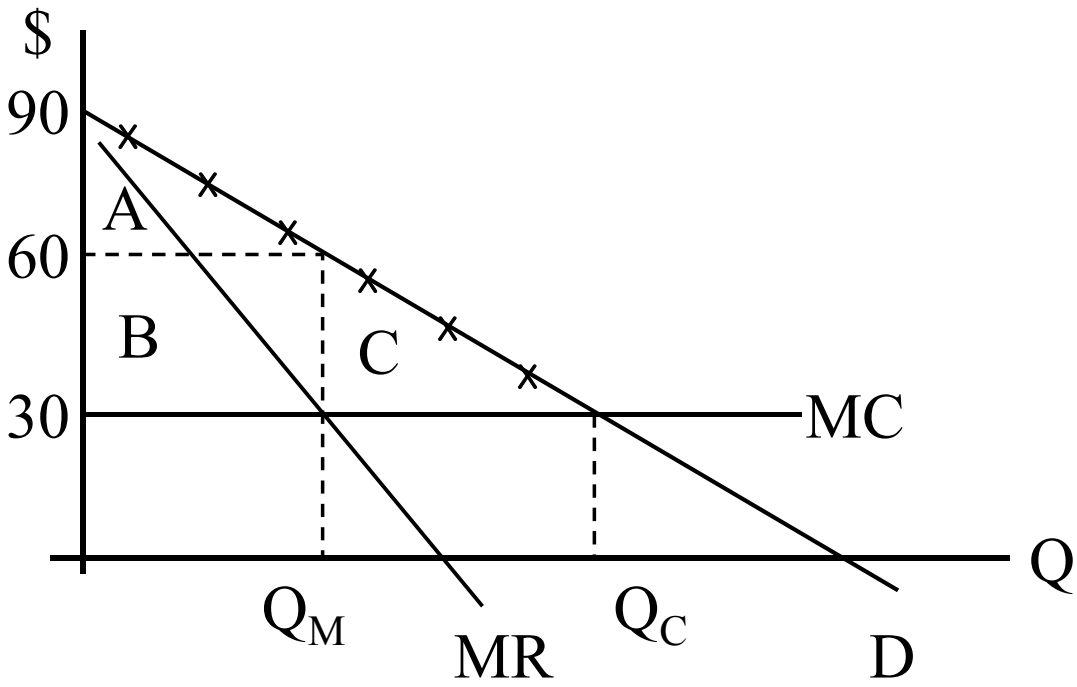
Every point on the demand curve is the reservation price

Sell at **reservation price** = maximum price of one's WTP

Monopoly

zero FCs and constant MC

2. Theory of PD - 1st degree PD



2. Theory of PD - 1st degree PD

	Monopoly Pricing	Perfect Competition	1st degree PD
CS			
PS			
DWL			
W			

2. Theory of PD - 1st degree PD

Policy of 1st degree PD

- Perfect PD maximizes W (Producers extracts every CS)
- High-WTP consumers worst off (loose CS relative to the Low-WTP consumers)
- Low-WTP consumers receive the good (come into the market)

2. Theory of PD - 1st degree PD

Applications

Sues cannel, used-car markets

Assumptions

1. Firm needs some market power
2. Detailed consumer's information of WTP
3. No resale (resale goes to uniform price)

2. Theory of PD - 2nd degree PD

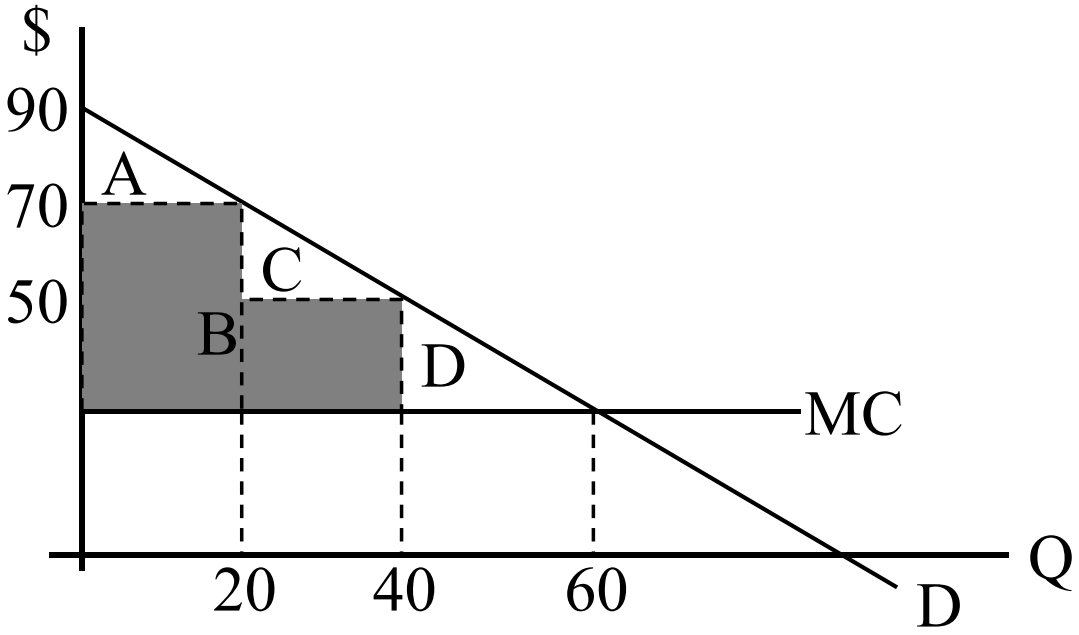
(iii) 2nd degree PD

Charge different prices for different units of output

Monopoly

same D-curve for each customer

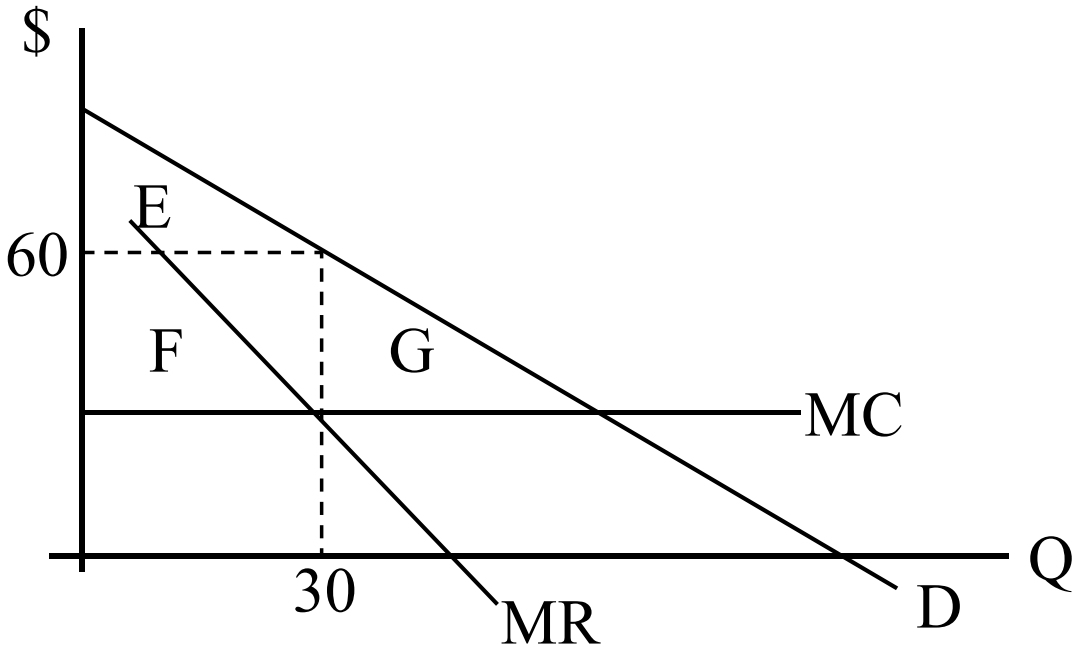
2. Theory of PD - 2nd degree PD



Declining Block Pricing:
$70 for the 1st 20 units, $50 for the 2nd 20 units

2. Theory of PD - 2nd degree PD

Uniform monopoly price



2. Theory of PD - 2nd degree PD

	Monopoly Pricing	Perfect Competition	2nd degree PD
CS			
PS			
DWL			
W			

2. Theory of PD - 2nd degree PD

W increased compared to the monopoly price, if demand is uniform over the quantity level

Applications

Price-Quantity package

Public utility: electricity, international call

Air-tickets 1st class: high-WTP

2nd class: low-WTP

2. Theory of PD - 3rd degree PD

(iv) 3rd degree PD = Group pricing

Units of output are sold to different groups for different price

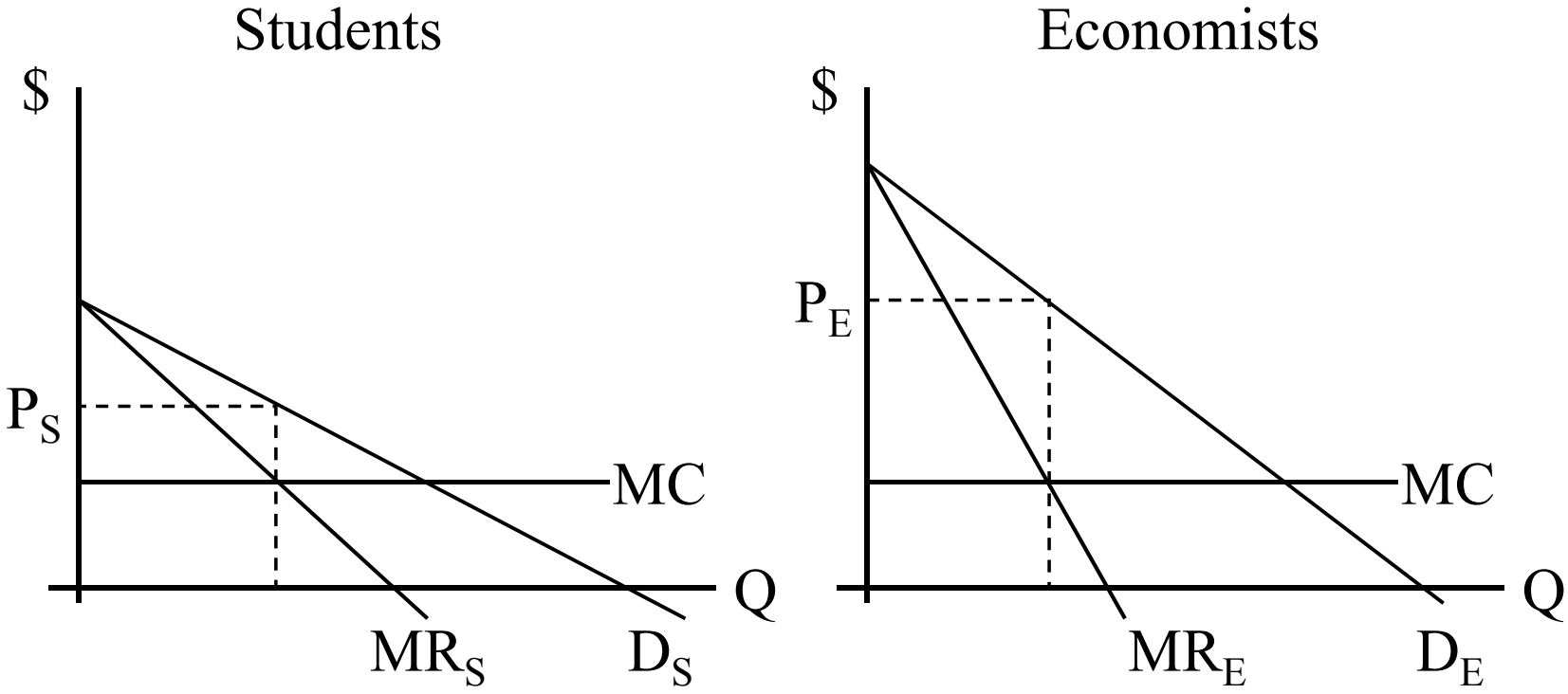
Senior citizens and students

Monopoly sells AER online

Two demand curves: Economists and Students

P lower for more elastic group

2. Theory of PD - 3rd degree PD



$MR_S = MR_E = MC$ maximizes the profit (Why?)

2. Theory of PD - 3rd degree PD

$$\frac{MR}{P} = (1 + \frac{1}{\eta}) \qquad \eta\text{: elasticity}$$

$$MR = P(1 + \frac{1}{\eta})$$

$$P_S(1 + 1/\eta_S) = P_E(1 + 1/\eta_E)$$

$$\frac{P_E}{P_S} = \frac{\frac{1}{\eta_S} + 1}{\frac{1}{\eta_E} + 1} \qquad \eta_S \downarrow, \quad P_E/P_S \uparrow$$

2. Theory of PD - 3rd degree PD

↑W as 3rd degree PD with more groups

→ 1st degree PD

Firms ↑ profits, consumers ↓ CS

Low-WTP consumers receive goods

2. Theory of PD

(v) Competition

On-line and off-line competition

1st degree PD allows competition and differentiation

- Enhanced surplus extraction
- Intensified competition effect: more firms in the market (Costco/E-mart/Department store)

Consumer heterogeneity: target consumer groups increases

↑ Competition effect with homogeneous tastes

2. Theory of PD

(vi) Summary

Price discrimination ↑ firm's profits

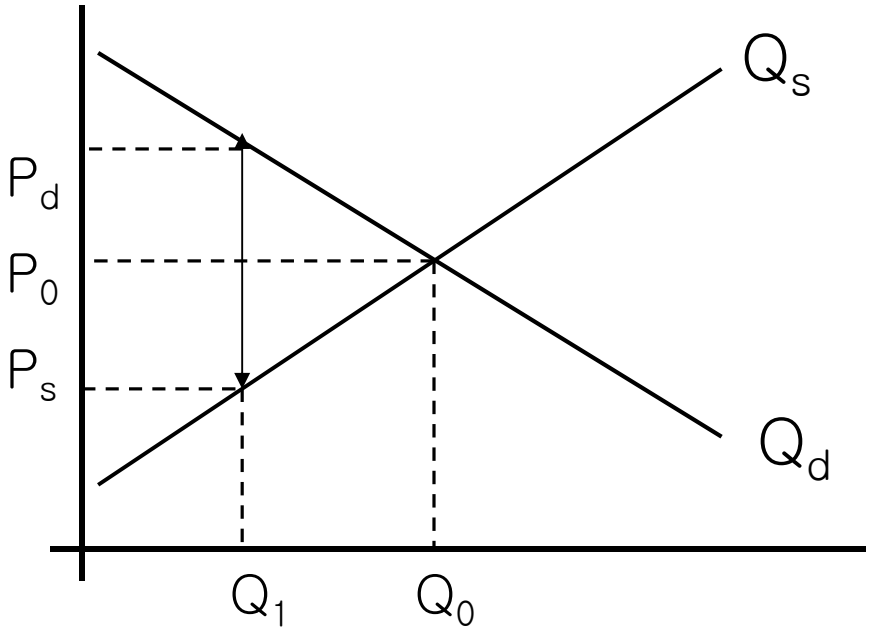
t-costs prevent perfect (1st degree) PD,

practice imperfect PD based on quality/groups

PD ↓ DWL and ↑ q to low-WTP customers

IT and the Internet lower t-costs

2. Theory of PD



Q_0: w/o transaction cost

Q_1: with transaction cost, t: $P_s + t = P_d$

3. IT, Dynamic Pricing, and Internet

IT reduces t-costs

(i) Menu costs

(ii) Consumer information

(iii) Market experimentation

3. IT, Dynamic Pricing, and Internet

(i) Menu costs

Cost of changing prices and menus

Cost to e-tailers is lower than the traditional market

Books.com

Separate out price-sensitive customers and price-insensitive customers

3. IT, Dynamic Pricing, and Internet

(ii) Consumer Information

Information indicates higher WTP

- PD algorithm
- Hardcover book customer, ↑P
- Return visitor, ↓P

More purchases lead to more information

3. IT, Dynamic Pricing, and Internet

(iii) Market experimentation

Online market experimentation

More price revising

Elimination of menu costs

4. Amazon.com

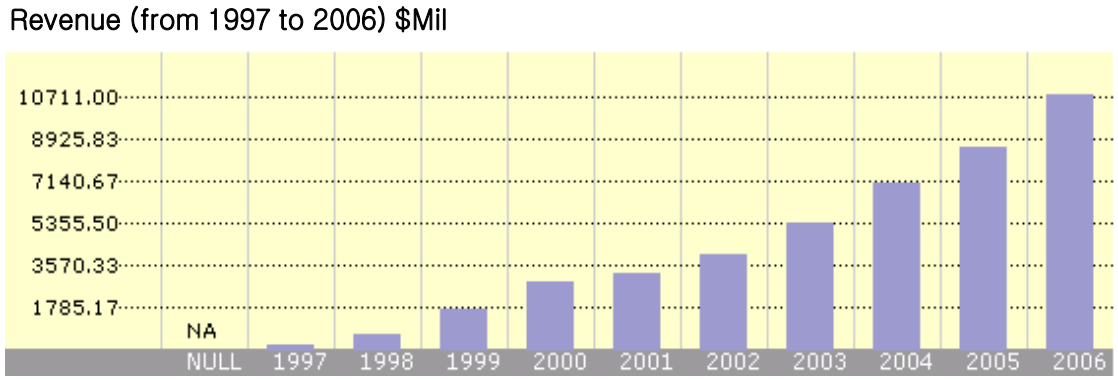
Over 70M active accounts worldwide (2007)

$14B net sales, $600M operating income (2007)

Collect detailed information

Price discrimination (9/2000)?

Demand curve estimation



4. Amazon.com

(i) Price discrimination

Prices vary geographically

- Transport, warehousing costs
- Region-specific taxes, and other costs
- Local competition
- Search costs

Demand curve estimation

- Business pricing with η (elasticity)

4. Amazon.com

(ii) What type of PD?

E-commerce analysts say PD

What kind of PD?

Estimate WTP from account information

- Name
- Area of residence
- Past buying
- Form of payment
- Form of shipment

4. Amazon.com

Group Pricing

Repeat customers less likely to search

- familiarity with web site
- familiar with payment method
- Perception of faster shipping

Lower η for Repeat (R) customers

Higher η for 1st time (F) customers

4. Amazon.com

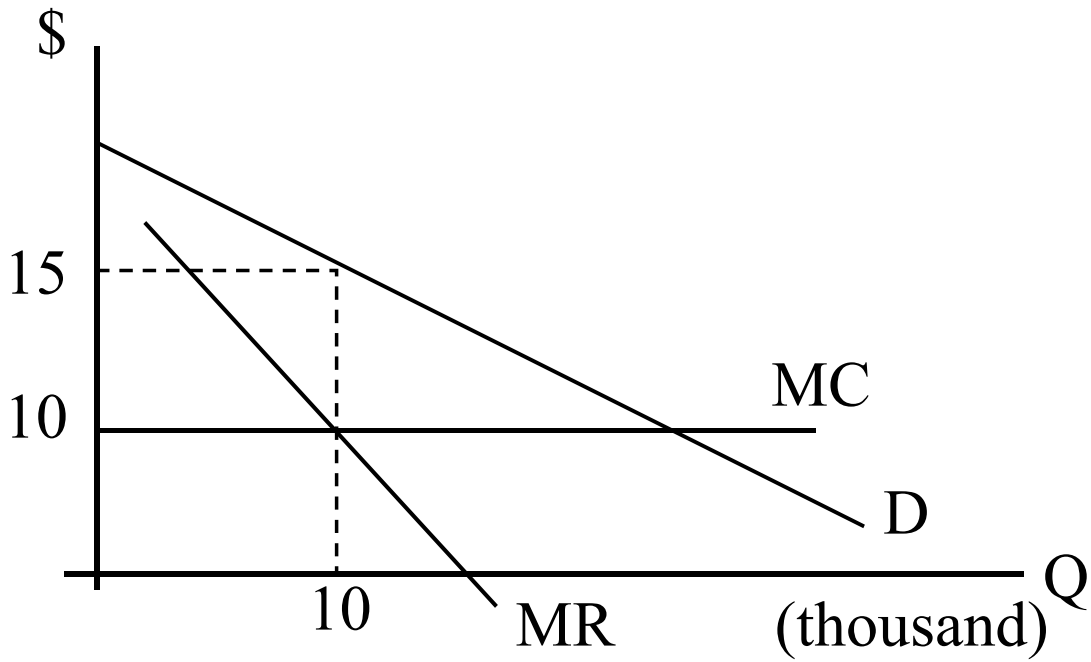
Ontario.com (a fictitious firm)

Uniform pricing

- Can't distinguish between R and F
- Market demand curve
- P = 15, Q = 10K, π = $50,000

4. Amazon.com

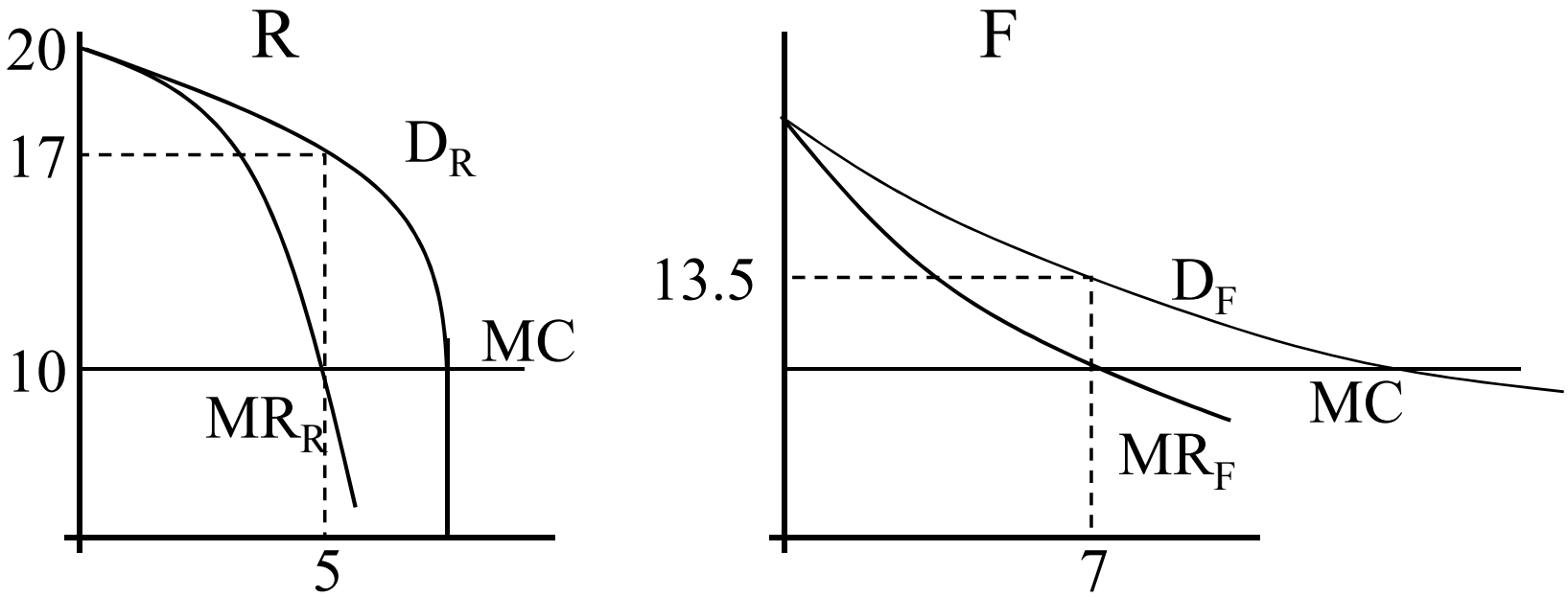
Uniform pricing



$\pi = (15\text{-}10)*10{,}000 = \$50{,}000$

4. Amazon.com

Price Discrimination between R and F



π_R=\$35,000 π_F=\$24,500

$\pi = \pi_R + \pi_F = 59{,}500 > 50{,}000$ (uniform pricing)

4. Amazon.com

PD?

Probably not illegal

Recourse to consumers

- Hide identity (use e-cash)
- Disable personal identifiers
- Resell in the other market (arbitrage)
- Take your business somewhere else

5. Versioning Information Goods

Pricing-by-identity

- 1st and 2nd degree PD
- Requires consumer profiles: expensive

Offer a menu of versions to consumers

- Allow self-selection: cost effective
- Don’t need expensive market data

5. Versioning Information Goods

(i) Self-selection

High and low-quality version

Allow self-selection

Observe how market splits

WTP revealed through selection

5. Versioning Information Goods

(ii) Examples

Sell different qualities at different price

Receive higher price for almost same cost

Book publishers: hard, soft cover

Laser printer: 5pages/min, 10pages/min

PhotoDisc.com

Fedex

- Over-night delivery
- 2nd delivery

5. Versioning Information Goods

(iii) Versioning Information

Seller knows rough distribution of WTP

Don’t know individual WTP

Set price according to quality of different version

Offer several versions and prices

5. Versioning Information Goods

StockQuotes.com (a fictitious firm)

Subscribers normalized to one

Low-WTP (type1): r

High-WTP (type2): 1-r

Prices are P_1 and P_2

5. Versioning Information Goods

Perfect PD

Producer can perfectly identify types of consumer

MC of incremental quality = 0

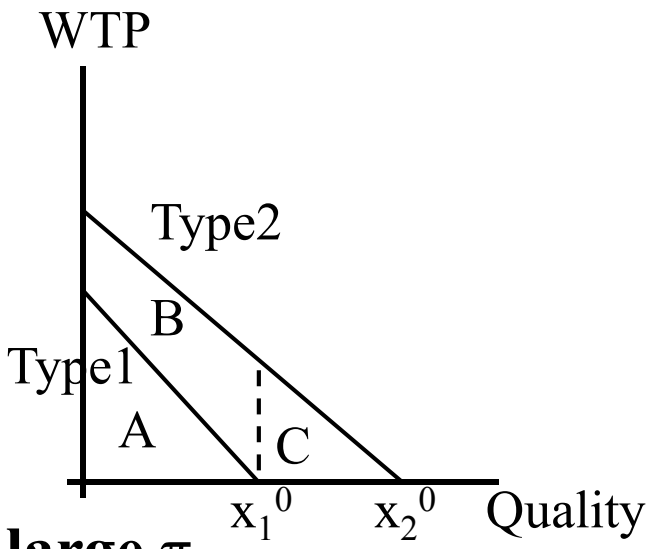
Price the good to extract entire CS

Choose quality at x_1^0 :

$P_1 = A$, $CS = 0$

Choose quality at x_2^0 :

$P_2 = A+B+C$, $CS = 0$



If PD not feasible, the producer choose large π

at x_1^0 with P_1 : $\pi = rA + (1- r)A = A$

at x_2^0 with P_2 : $\pi = (1-r)(A+B+C)$

5. Versioning Information Goods

With self-selection (Versioning)

The (P_1, x_1^0) does not satisfy the self selection constraints

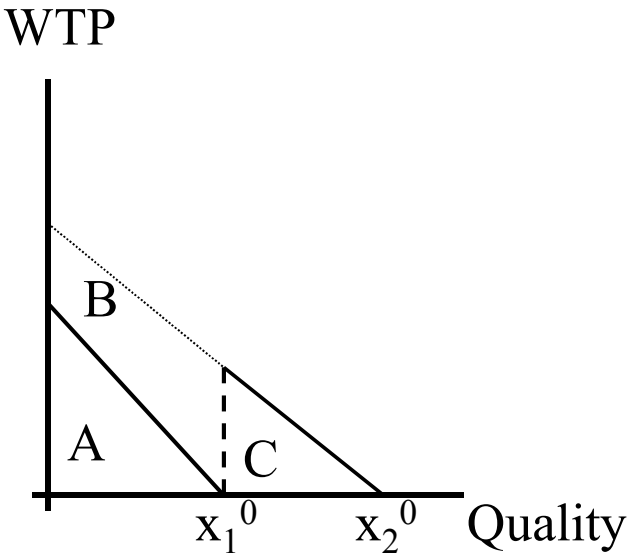
The high WTP customer can choose (P_1, x_1^0) intended for the low WTP customers and achieve CS = B

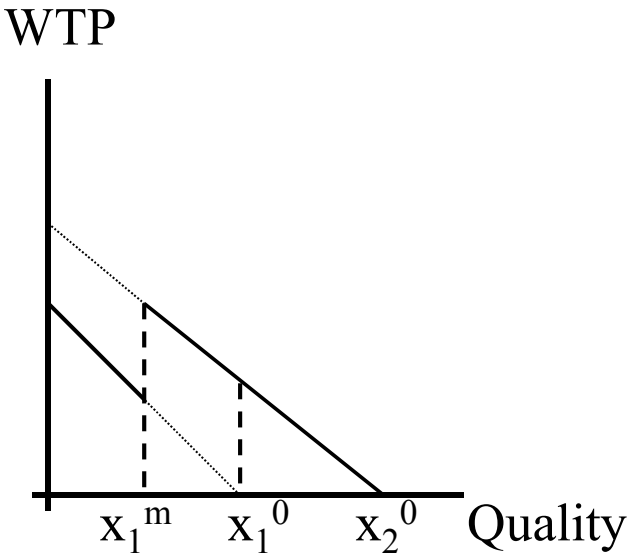
To induce self selection set P_2 = A+C for x_2^0 with CS = B

This pricing is more profitable than (P_1, x_1^0)

5. Versioning Information Goods

Versioning





at x_1^0 : $P_1 = A$, $CS_L = 0$, $CS_H = B$

at x_2^0 : $P_2 = A+C$, $CS_H = B$

$\pi = A + (1- r)C > A$

at x_1^m :

at x_2^0 :

π

5. Versioning Information Goods

Proposition

Reduce the low-quality until the marginal reduction in revenue from the low-WTP customers just equals the marginal increase in revenue from the high-WTP customers

6. Quality dimension, Design and Self-selection

(i) Quality dimensions for versioning

Delay

Resolution

User interface

Speed of software

Support

Comprehensiveness

6. Quality dimension, Design and Self-selection

(ii) Design for versioning

Max Profits by ↓ quality at low-end

Design for high-end and degrade the low-end

Control the browser

6. Quality dimension, Design and Self-selection

(iii) Making self-selection work: keep quality difference

Cannibalization of high-value customer revenue

To prevent cannibalization

- Reduce the price of the high-end product
- Increase the quality of the low-end version

Effectively the same

7. Goldilocks Pricing

Successful versioning

(i) Online/offline versions

(ii) How many versions?

(iii) Goldilocks pricing

7. Goldilocks Pricing

(i) Online/offline versions

Is online a complement/Substitute to offline?

Substitute

- Charge for it
- Recover costs through advertising
- Version it

Complement

- Promote aggressively as possible
- Encourage sales of offline

7. Goldilocks Pricing

(ii) How many versions?

Too many versions has costs

Analyze market:

- professional/business/amateur user

Analyze product

- How many dimensions
- High/low-end for each dimension
- Design high-end and degrade at the low-end
- Low-end advertises for high-end: lock-in

7. Goldilocks Pricing

(iii) Goldilocks Pricing

Three versions is best

'Extremeness aversion' (Two versions)

small/medium/large vs. medium/large/jumbo

Market experiments

Example: Technical Support for softwares

Low: no technical support

Medium: some support with payment

Jumbo: technical support w/o delay

8. Welfare and Policy

Is lowering quality bad?

Economists support versioning

- Serve market that otherwise would not be served
- Output effect > quality reduction effect

Antitrust policy (or Competitive policy)

- Are new markets served?
- Yes, versioning ↑ W