# EE481 Industrial Economics

## Price Discrimination

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# Case Study (Grabowski and Vernon, 1992)

Does competition always lower price?

- New drugs get patents to grant their monopoly rights.
- But after the patent expires, anyone else can use the formula to produce their drugs (generic brands).
- Grabowski and Vernon (1992) found that after the patent (of 18 major drugs) expires, sale dropped by 50% but price increased 10%.
  - Apparently, there are 2 types of consumers - the loyal and the price-sensitive.
  - The loyals do not switch to generics and are willing to pay more.
  - The patented firm then focus only on the loyal customers -> and charge a higher price.

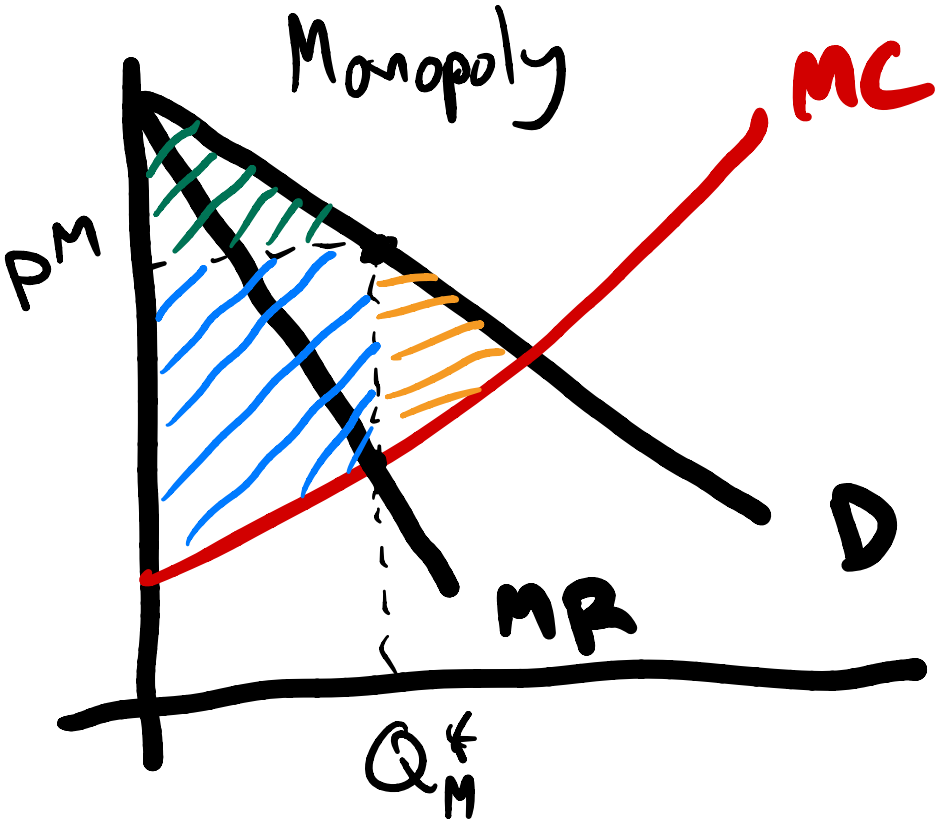
# What you have learned in microeconomics

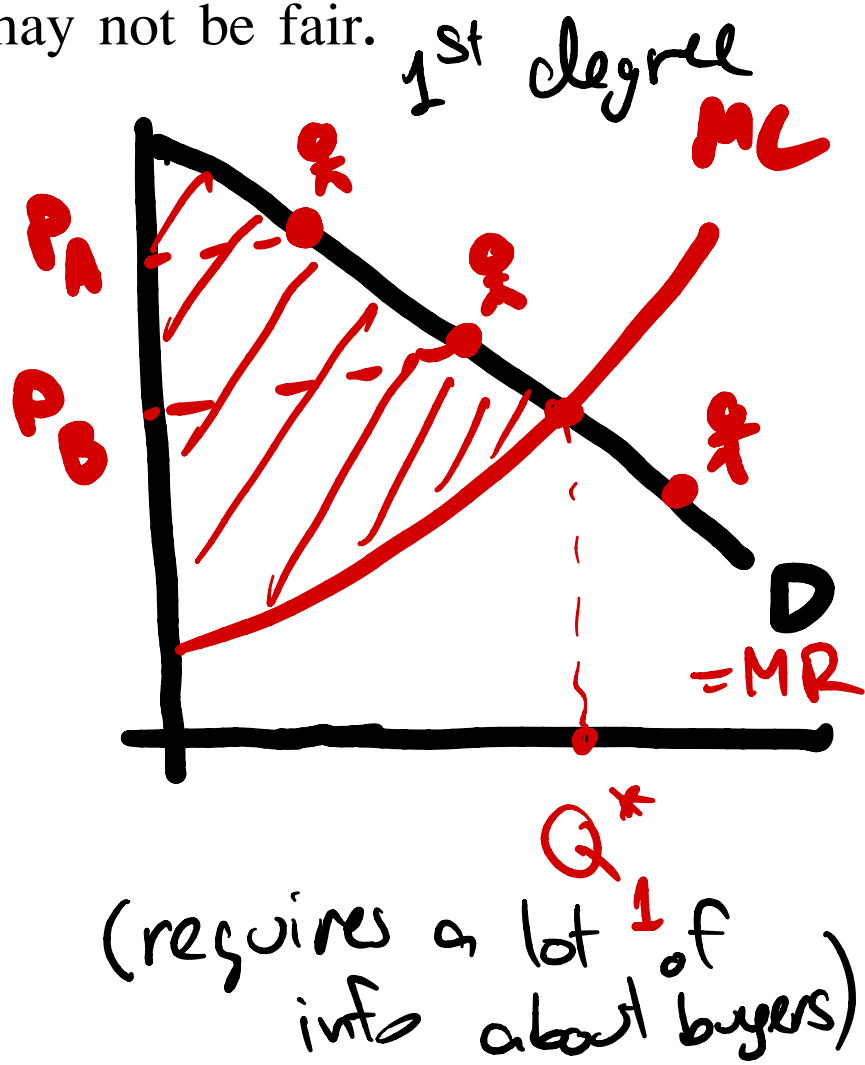
Price-discrimination = charging the consumers different prices for the same product. (firms would like to extract more consumer surplus)
We examine three questions

- Firms have to have some market power in order to price discriminate.
- Price discrimination can be categorized into 3 types
  1. First-degree - perfect price discrimination
  2. Second-degree - price discrimination with asymmetric information
  3. Third-degree - local monopoly

# Perfect Price Discrimination (First-Degree)

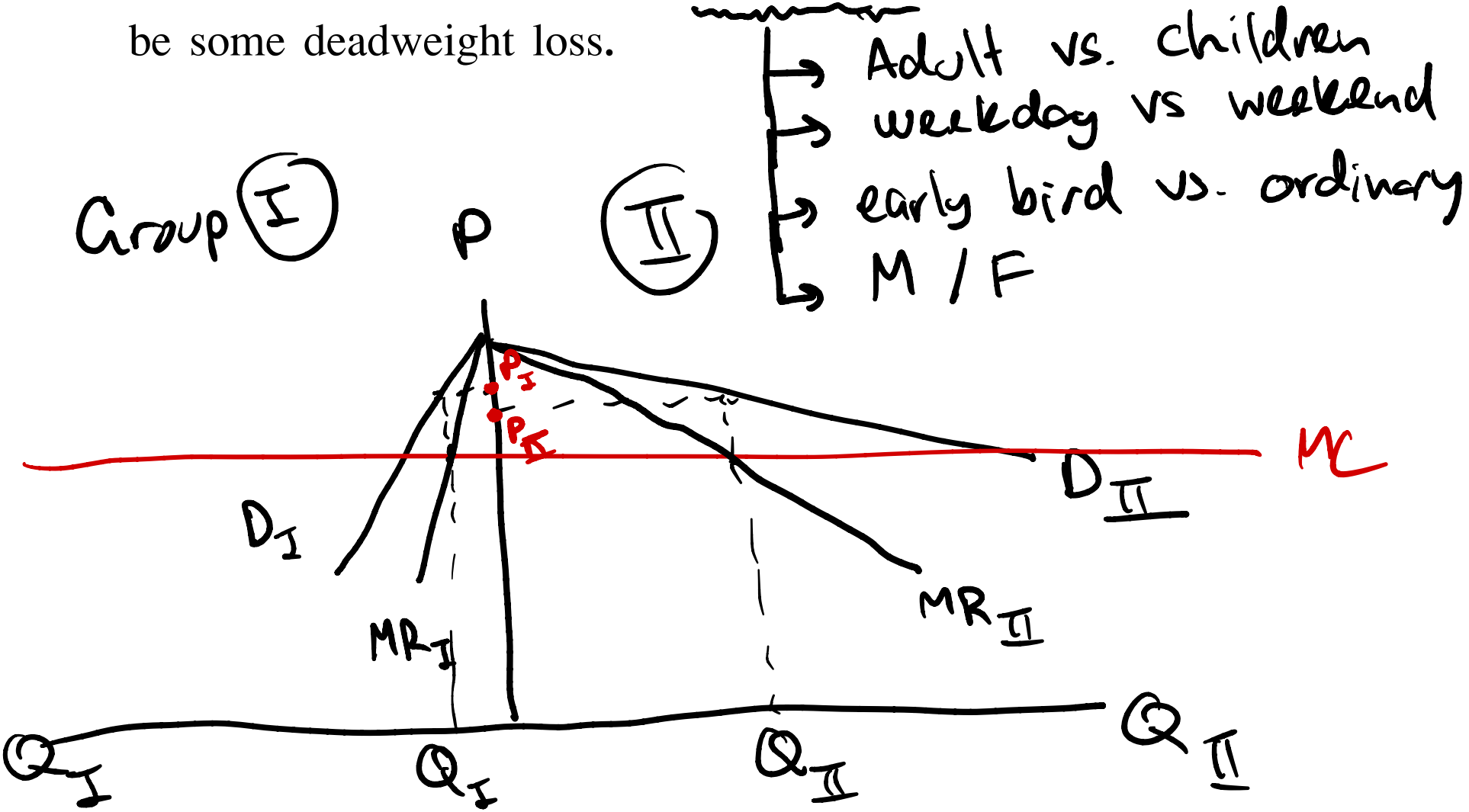
- Firm can identify the willingness to pay of every consumer.
- No dead-weight loss -> efficient but may not be fair.



# Third-Degree Price Discrimination

- Profit-maximizing price for ``each group'' of consumers. There could be some deadweight loss.



# Third-Degree Price Discrimination (maths)

Recall from the derivation of $\frac{P-mc}{P}$ in the SCP chapter.

$$\frac{P - mc_i}{P} = \frac{s_i}{\varepsilon},$$

where $mc_i$is firm $i$'s marginal cost, $s_i$is firm $i$'s market share in an oligopoly market, $\varepsilon$ is the point elasticity of demand (at the equilibrium price).

$$\text{Max}\,\Pi \Rightarrow PQ - cQ = P(Q).Q - cQ$$

$$\frac{d\Pi}{dQ} = P(Q) + Q\,P'(Q) - C = 0$$

$$\frac{P-C}{P} = -\frac{Q\,P'(Q)}{P}$$

Mark up

$$\frac{P-C}{P} = -\frac{Q}{P}\cdot\frac{dP}{dQ}$$

$$= -\frac{dP/P}{dQ/Q} = -\frac{\%\Delta P}{\%\Delta Q}$$

$$= -\frac{1}{\varepsilon_d} = \frac{1}{|\varepsilon_d|}$$

$$\frac{P-C}{P}\uparrow = \frac{1}{|\varepsilon_d|}\downarrow$$

# Second-Degree Price Discrimination

Price discrimination can be categorized into 3 types according to the completeness of information

1. First-degree - firm observes the willingness to pay of EACH buyer.
2. Second-degree - firm does not observe the willingness to pay of EACH buyer. But knows that different buyers have different willingness to pay.
3. Third-degree - firm observes the willingness to pay of EACH GROUP of buyers.

# Price Discrimination Mind Map

# Second-Degree Price Discrimination

↳ nonlinear pricing

Some forms of second-degree price discrimination

- Two-part tariff
- Multi-part tariff
- Menu of Price or Price schedule
- Bundling, Tie-in sale

# Second-Degree Price Discrimination

Second-degree price discrimination is a form of non-linear pricing.

Nonlinear Pricing = consumer's price per unit is not a constant

- Second-degree price discrimination uses the nonlinear pricing method to extract welfare from consumers.

- WTP is unobservable
- Firm knows that buyers have different WTP

# Examples of Two-Part Tariff

→ lump-sum fee

→ per usage fee

Firm changes a lump-sum fee AND a per-unit fee.

| Product | Lump-sum | Per-unit fee |
|---|---|---|
| Nespresso | Machine | capsule |
| Football Game | Membership fee | ticket price |
| Nintendo Wii | console | game |
| Printer | Machine | ink |
| Bank Loan | admin | interest rate |

+insurance fee

# Examples of Two-Part Tariff

Firm changes a lump-sum fee AND a per-unit fee.

| Product | Lump-sum | Per-unit fee |
|---|---|---|
| Nespresso | Nespresso Machine | Coffee Capsules |
| Football Game | | |
| Nintendo Wii | | |
| Printer | | |
| Bank Loan | | |

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| Football Game | Membership fee | Ticket fee |
| Nintendo Wii | Nintendo Wii | Game |
| Printer | Printer | Ink |
| Bank Loan | | |

# Examples of Two-Part Tariff

Firm changes a lump-sum fee AND a per-unit fee.

| Product | Lump-sum | Per-unit fee |
|---|---|---|
| Nespresso | Nespresso Machine | Coffee Capsules |
| Football Game | Membership fee | Ticket fee |
| Nintendo Wii | Nintendo Wii | Game |
| Printer | Printer | Ink |
| Bank Loan | Collateral | Interest rate |

# A Single Two-Part Tariff

- Suppose there are 2 types of consumers
  1. the High willingness to pay (high-type)
  2. The Low willingness to pay (low-type)

Two-part tariff (A, P);

A = lump-sum

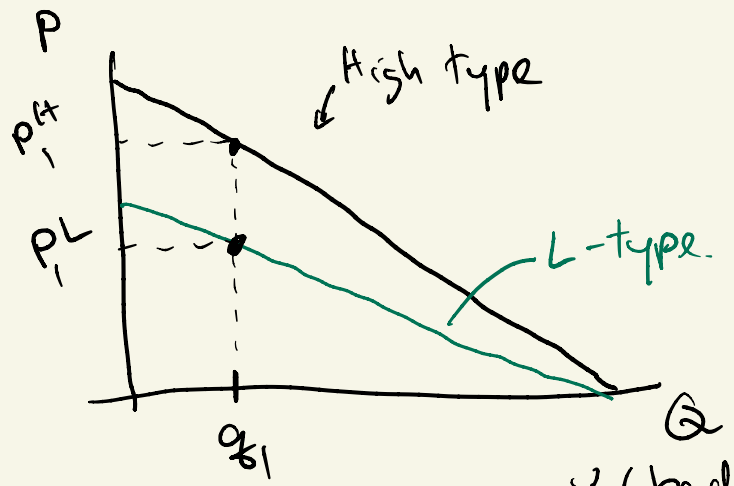
P = per-unit price

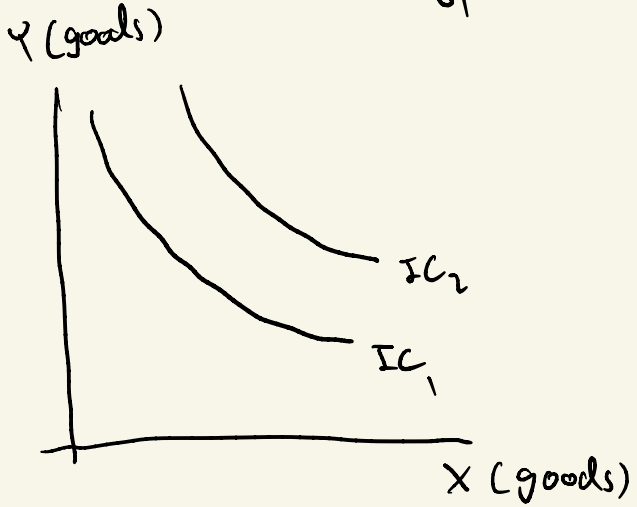
Single TPT => (A, P)

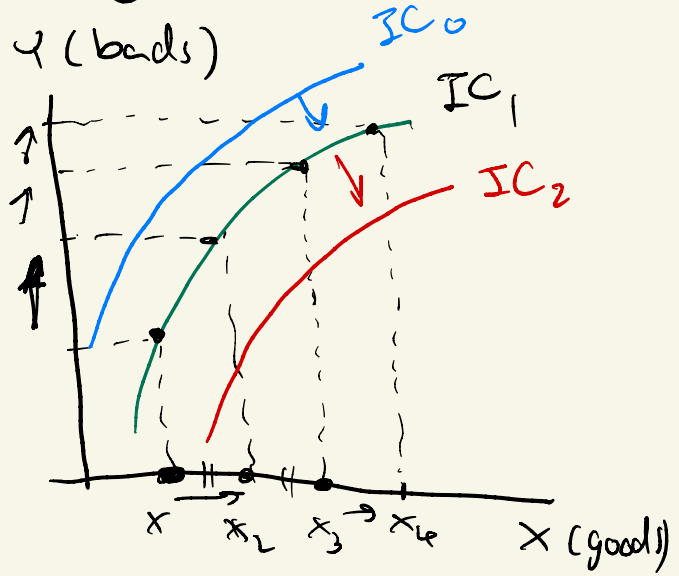
Multiple-TPT => $(A_1, P_1)$

$(A_2, P_2)$

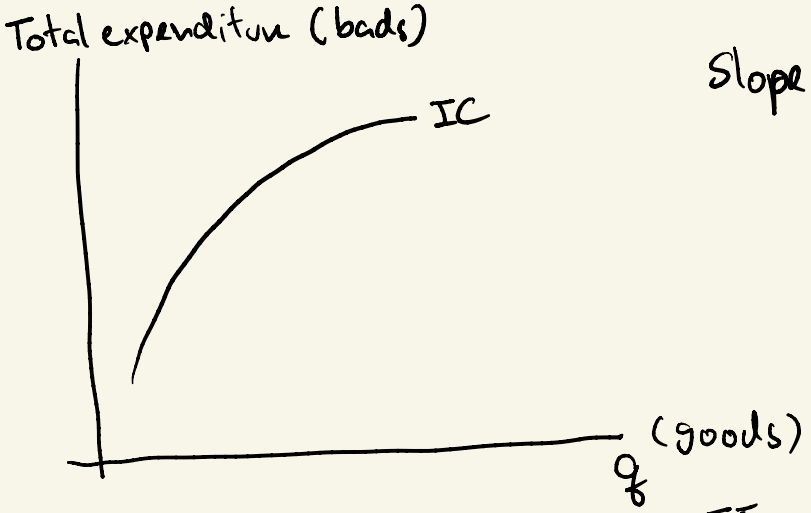
$(A_3, P_3)$




$$U_{IC_2} > U_{IC_1} > U_{IC_0}$$




Slope of IC $= \frac{d \text{ total exp}}{dq_f}$

$= \frac{d(q_f \times WTP_{\text{per unit}})}{dq_f}$

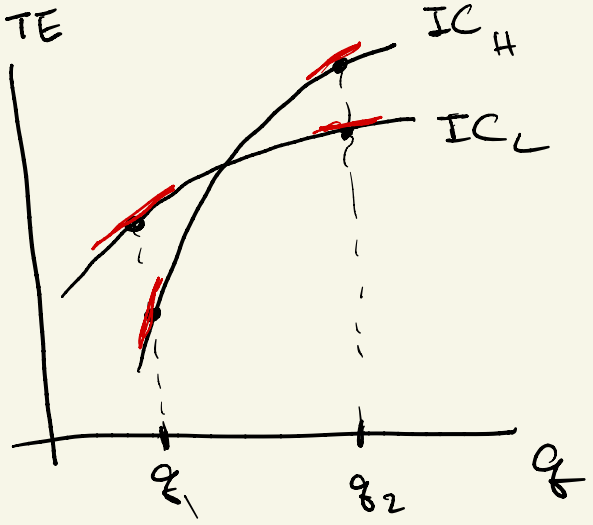
$= P \Rightarrow$ willingness to pay for $q_f$ consumers

Consumer → H-type (high WTP)

→ L-type (Low WTP)

IC of H-type is always steeper than L-type for all $q_f$

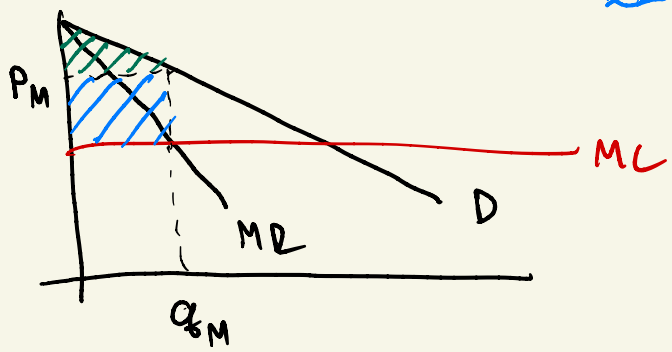
↳ This represents the fact that H consumers have higher WTP than L consumers



Example: 1 group of consumer

▨ = Π  ◺ = CS

Monopolist

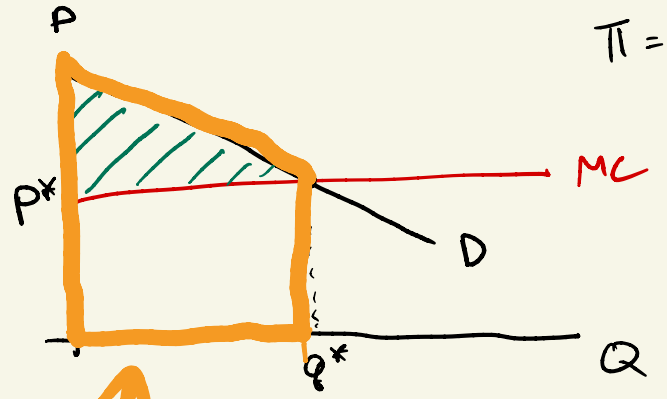



Optimal TPT

$(A^*, p^*)$

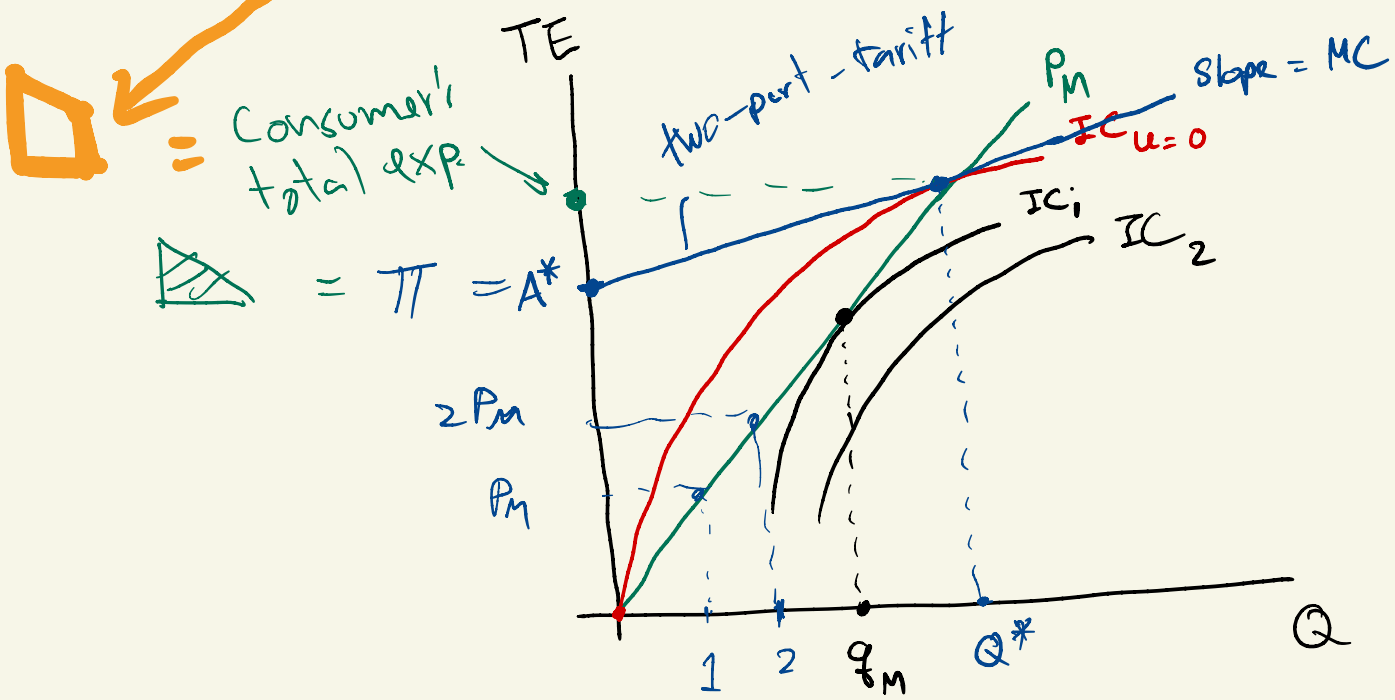
$A^* = 9$ ◺

$p^* = 9 = MC$

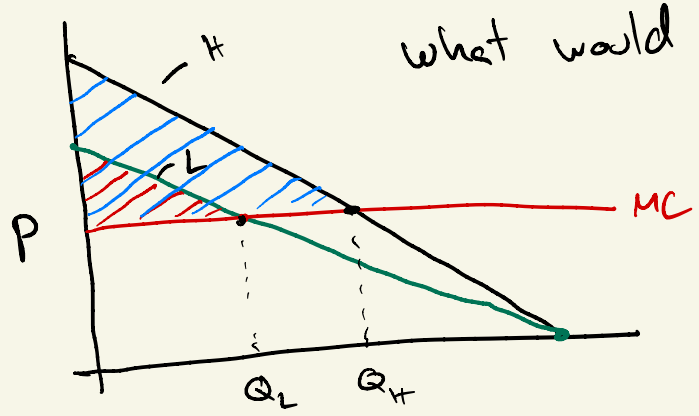



$\Pi =$ ◺ , CS=0

▱ = Consumer's total expenditure


= Consumer's total exp.
= π = A*
TE
two-part - tariff
$P_M$
Slope = MC
$IC_{u=0}$
$IC_1$
$IC_2$
$2P_M$
$P_M$
1
2
$q_M$
$Q^*$
Q

Ex 2 types of consumers




what would be optimal TPT?

= surplus of H

= surplus of L

Two options available

option 1: P = MC and A =  => both types will buy

option 2: P = MC and A =  => only H-type will buy

which option is better? This depends on the relative size of two types consumers

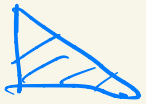
Suppose that total population 1 $\rightarrow$ $\alpha \Rightarrow$ L

$\searrow$ $1-\alpha \Rightarrow$ H

Option 1 ($A =$  )

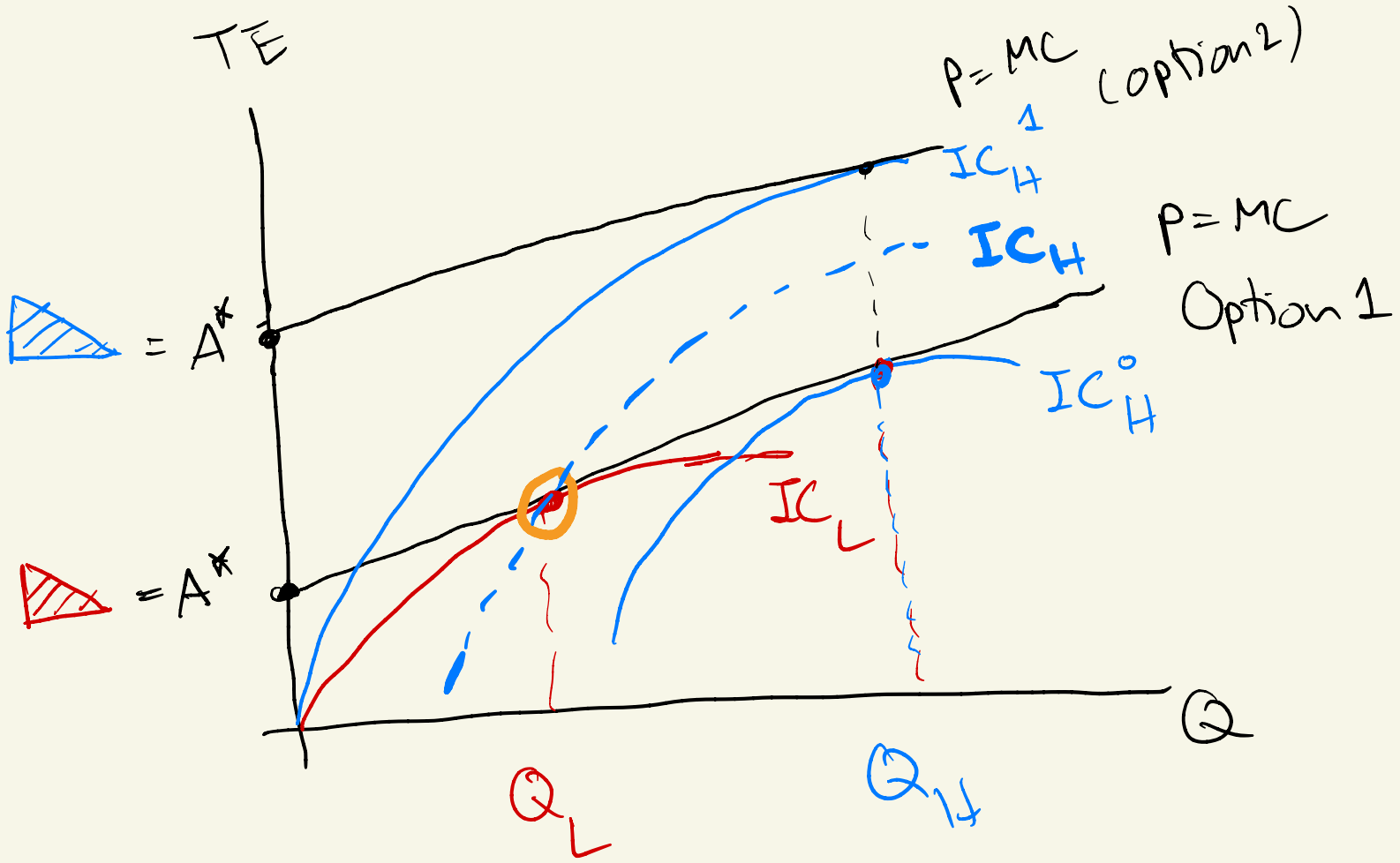
$\pi =$ $\alpha$  $+ (1-\alpha)$  $=$ 

Option 2 ($A =$  ) $\Rightarrow$ only H will buy

$\pi = (1-\alpha)$ 

Option 1 is optimal if

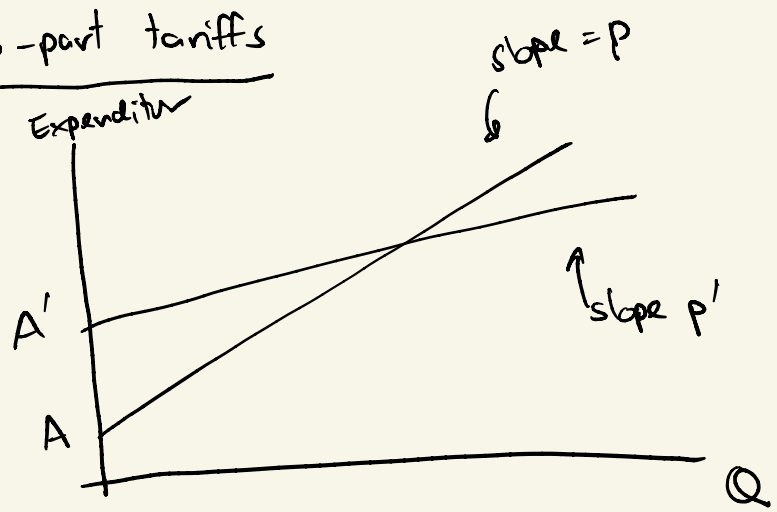
 $\geq (1-\alpha)$ 


TE
P = MC
1
(option 2)
IC_H
IC_H
P = MC
Option 1
= A*
IC°_H
IC_L
= A*
Q
Q_L
Q_H

# Two Two-Part Tariff

- Firms can increase their profits from offering two two-part tariff instead of a single two-part tariff
  - different collateral-interest rate combinations
  - different co-payment and insurance premium combinations
  - offering buffet or a'-la-carte

## Two two-part tariffs

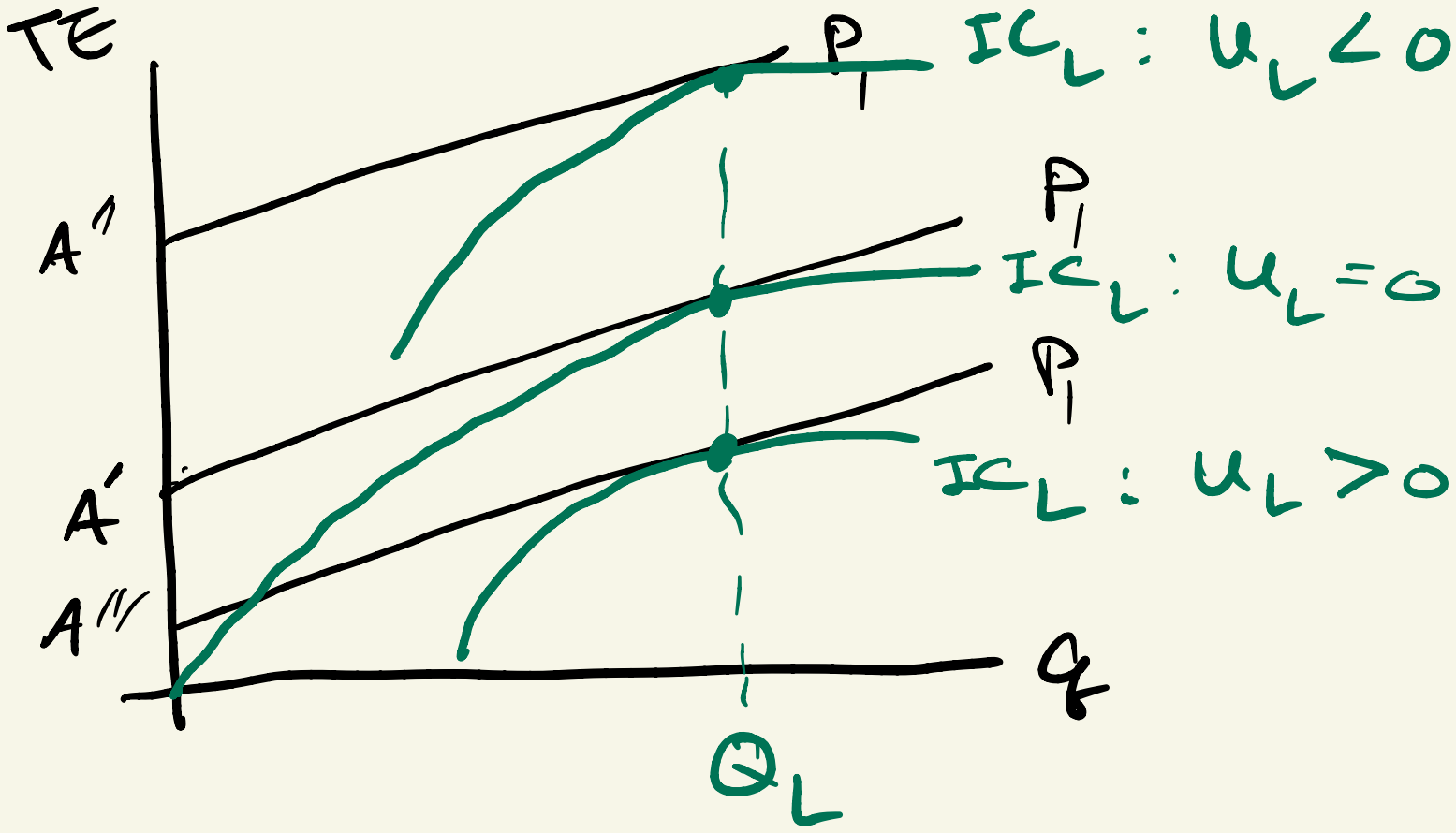


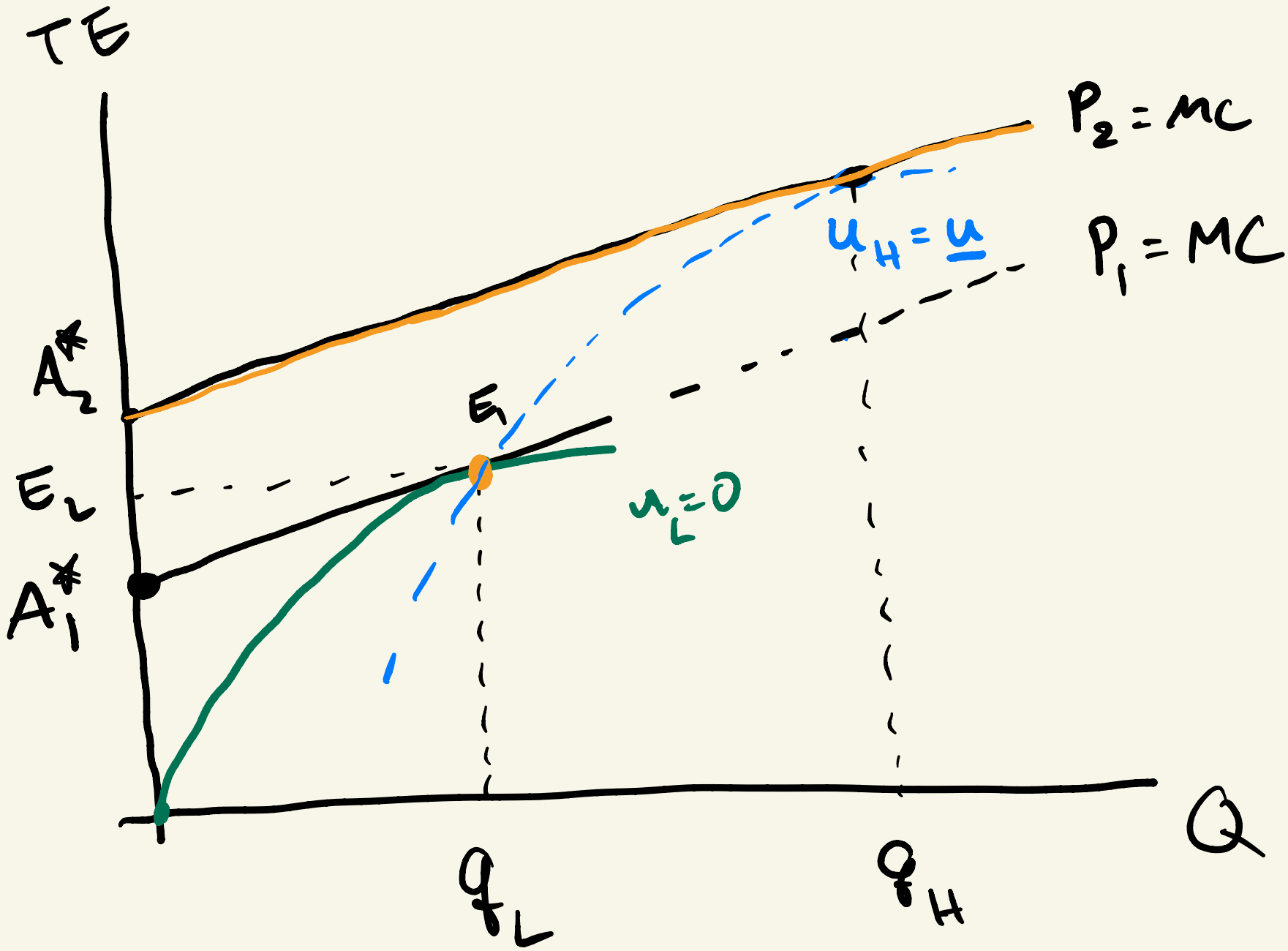

Two-part tariff $(A, P)$

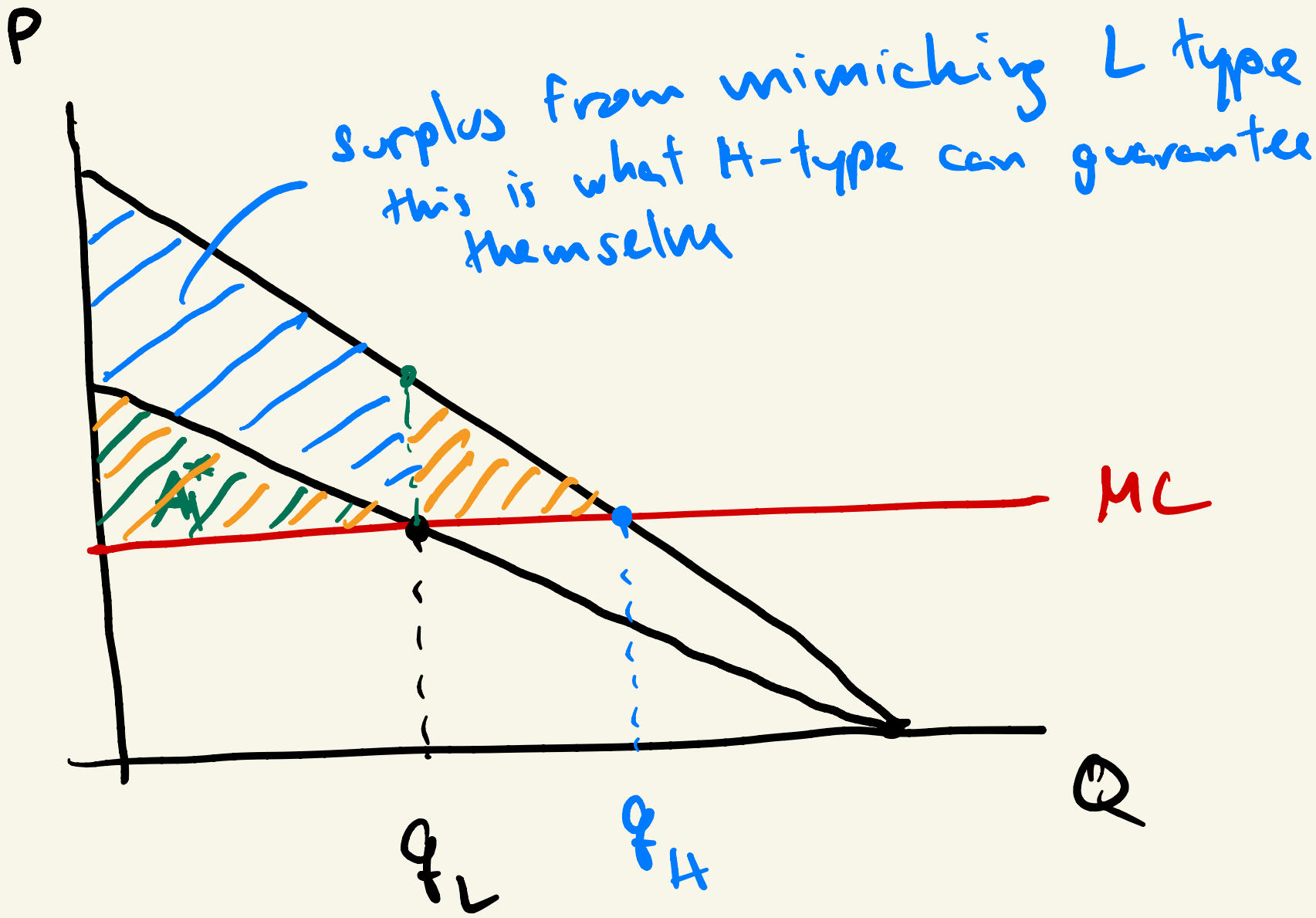
Total expenditure $E = A + pQ$

See Church and Ware Ch5

- Firm set $(A_1, P_1)$ and $(A_2, P_2)$
- Suppose firm set $P = P_1$ => $A_1$ must be chosen so that consumer surplus of L-type is fully extracted => $CS_L = 0$

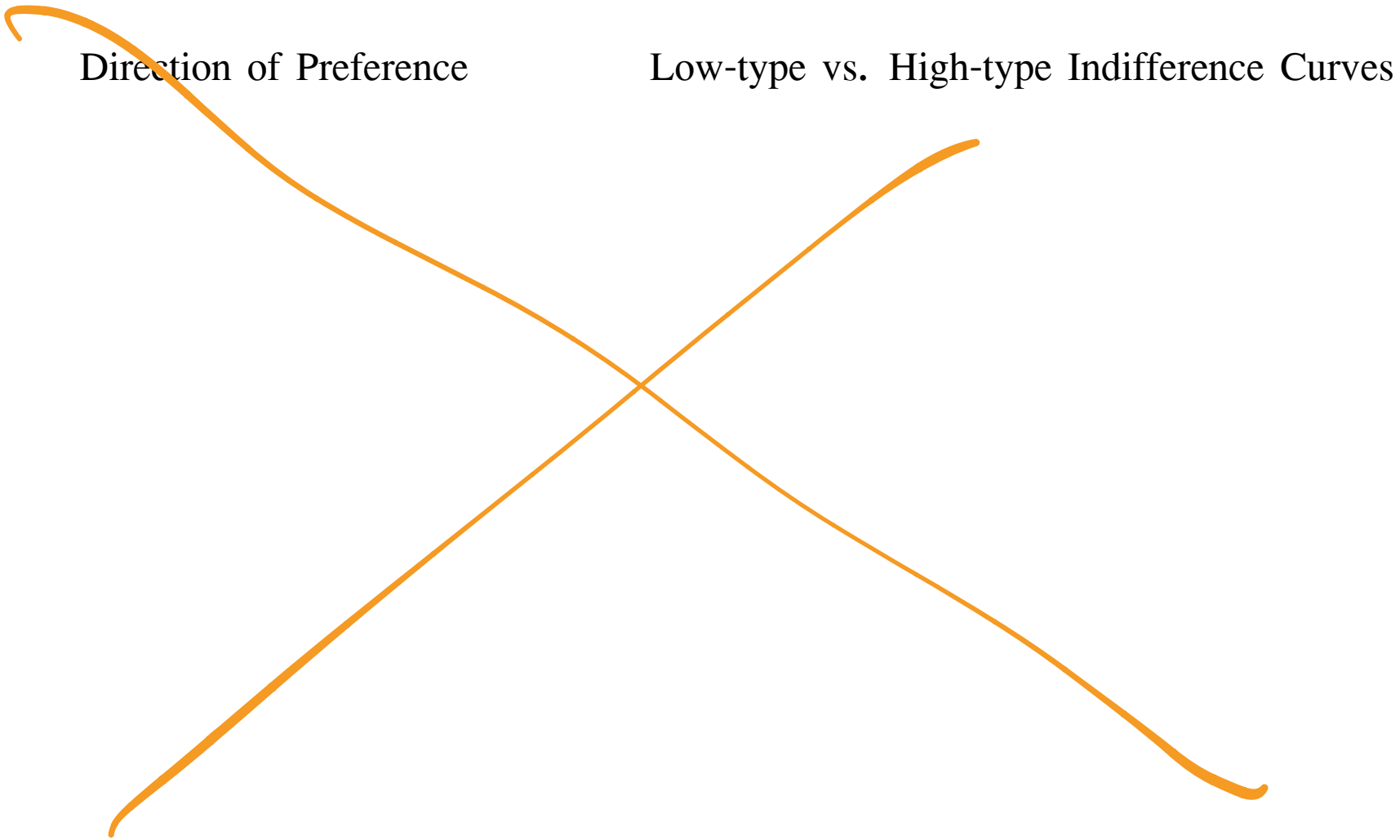

TE
A'
A''
A'''
P
P'
P''
IC_L : U_L < 0
IC_L : U_L = 0
IC_L : U_L > 0
q
Q_L


TE
$P_2 = MC$
$P_1 = MC$
$u_H = u$
$A_2^*$
$E_1$
$E_L$
$u_L = 0$
$A_1^*$
Q
$q_L$
$q_H$


P
surplus from mimicking L type
this is what H-type can guarantee
themselves
MC
Q
$q_L$
$q_H$

$A_2^x =$ 

# Consumers' Indifference Curves



# The low-type usually get most of their surplus extracted

- Suppose there are 2 types of consumers.
  - Type 1 (Low-type) : has a low valuation of the product
  - Type 2 (High-type) : has a high valuation of the product
- First, Suppose the company design a two-part tariff that extracts all surplus from the low-type

# If only 1 two-part tariff is offered the high-type buys more q

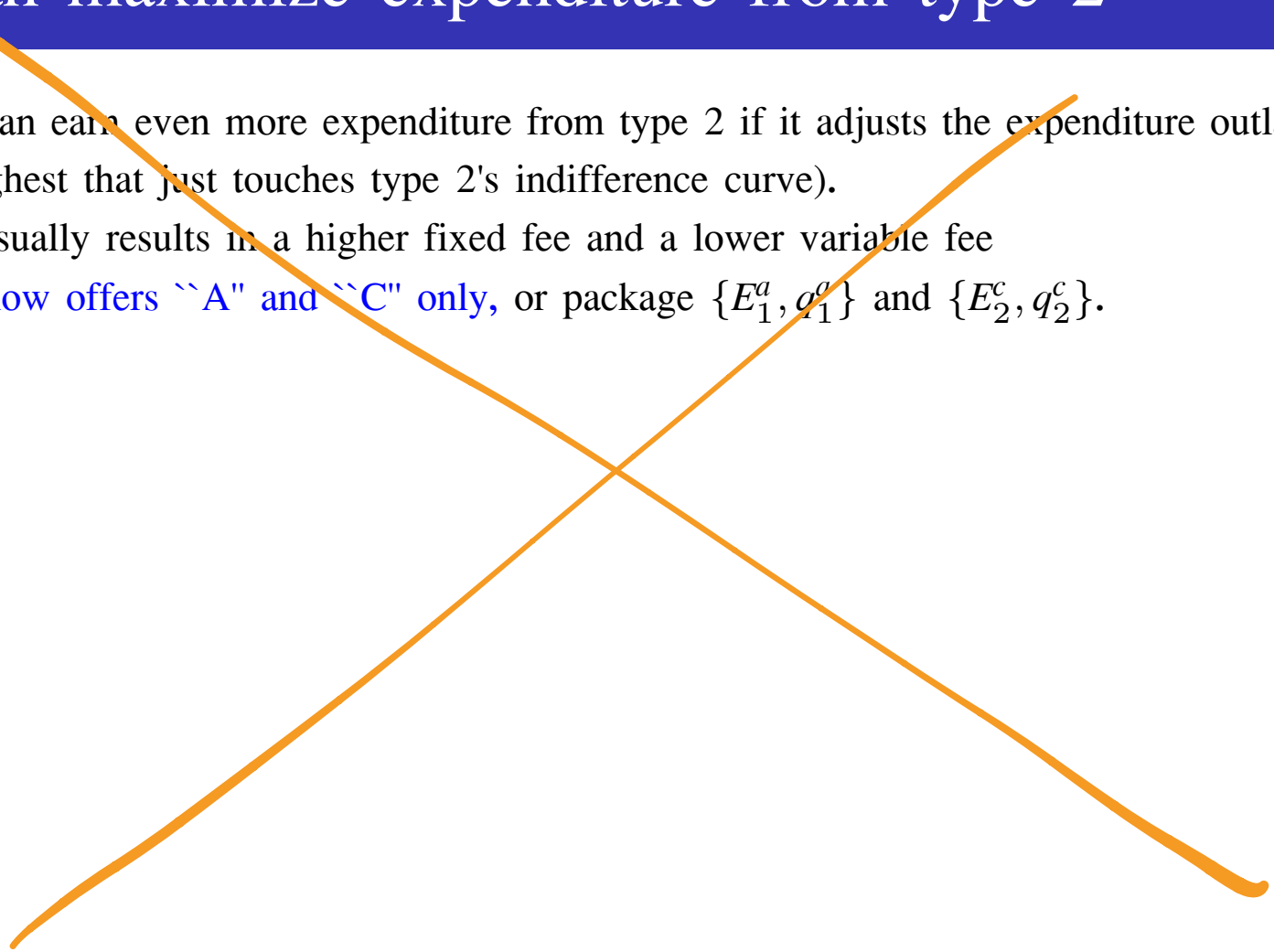
- Suppose this company offers only 1 two-part tariff (call tariff $a$) the high-type would maximize their utility by choosing at point ``$B$''
  - Type 1 (Low-type): chooses $\{E_1^a, q_1^a\}$
  - Type 2 (High-type): chooses $\{E_2^a, q_2^a\}$

# Type 2 has more surplus for firm to extract

- Let's suppose firm would like to extract more surplus from Type 2.
- This can be done by moving the expenditure outlay for type 2 up and up. (Assume Parallel Shifts for now)
- As long as Type 2's indifference curve is below point ``$A$'', Type 2 consumer would not choose point ``$A$''.
- Firm now offers ONLY ``A'' and ``D'', or package $\{E_1^a, q_1^a\}$ and $\{E_2^d, q_2^d\}$.
- You can check that type 1 would choose $\{E_1^a, q_1^a\}$ and type 2 would choose $\{E_2^d, q_2^d\}$.

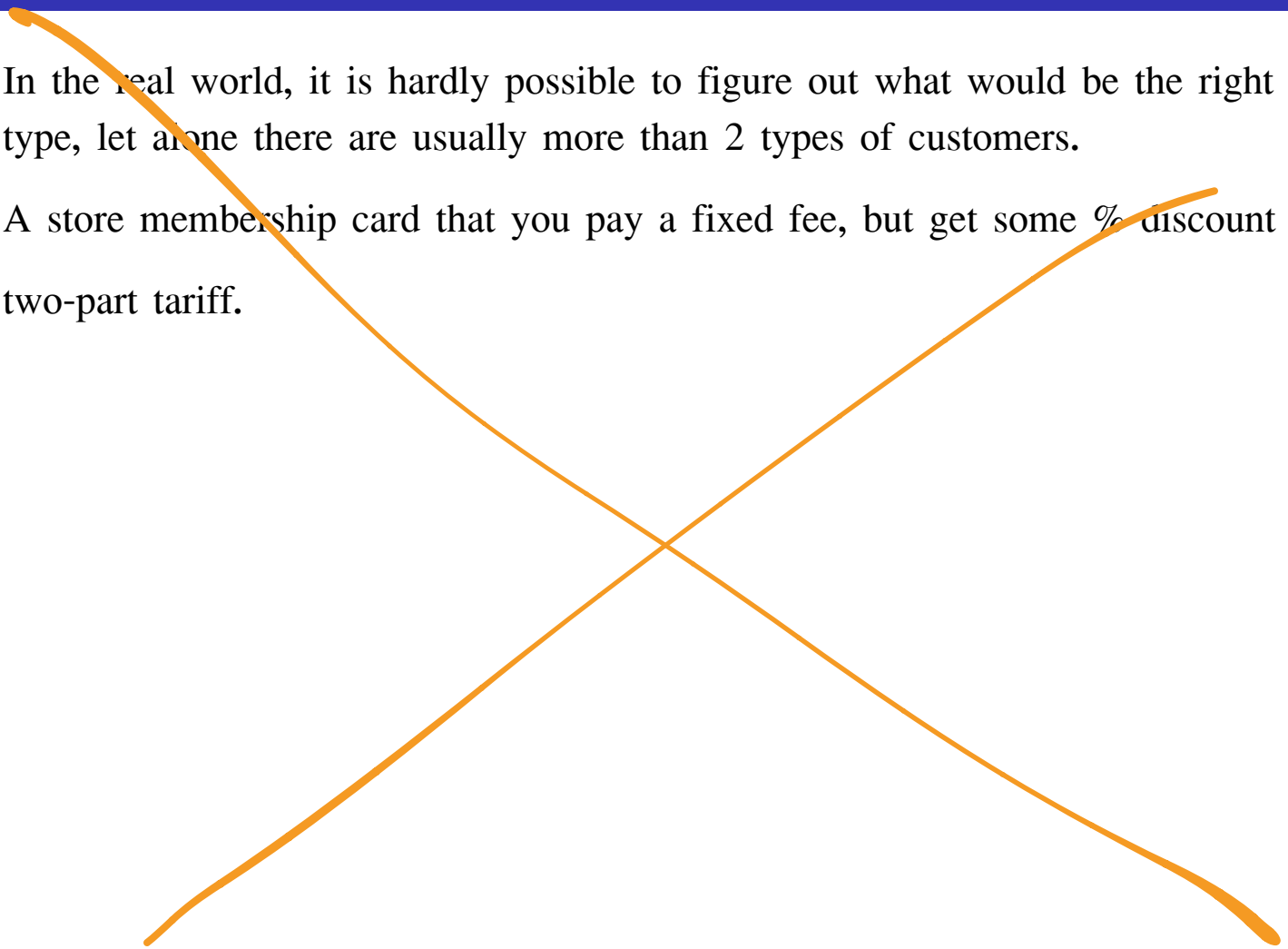
# Firm can maximize expenditure from type 2

- Firm can earn even more expenditure from type 2 if it adjusts the expenditure outlay (to achieve the highest that just touches type 2's indifference curve).
- This usually results in a higher fixed fee and a lower variable fee
- Firm now offers ``A" and ``C" only, or package $\{E_1^a, q_1^a\}$ and $\{E_2^c, q_2^c\}$.

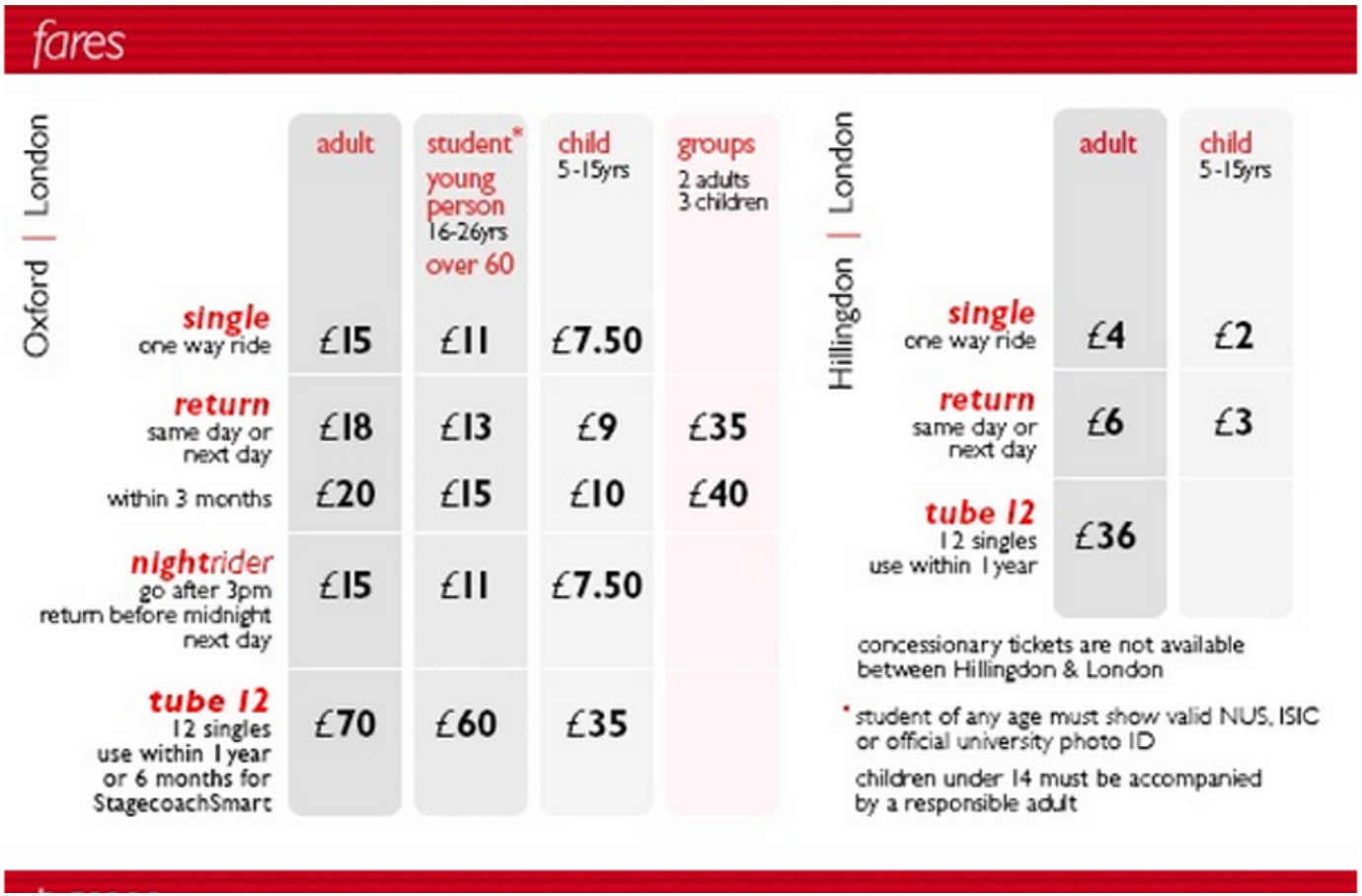


# Can this be done in the real world?

- In the real world, it is hardly possible to figure out what would be the right $E$ and $q$ for each type, let alone there are usually more than 2 types of customers.
- A store membership card that you pay a fixed fee, but get some % discount is a kind of two two-part tariff.



# Is this a 1st, 2nd or 3rd degree price discrimination?



fares

Oxford | London

| | adult | student* young person 16-26yrs over 60 | child 5-15yrs | groups 2 adults 3 children |
|---|---|---|---|---|
| **single** one way ride | £15 | £11 | £7.50 | |
| **return** same day or next day | £18 | £13 | £9 | £35 |
| within 3 months | £20 | £15 | £10 | £40 |
| **nightrider** go after 3pm return before midnight next day | £15 | £11 | £7.50 | |
| **tube 12** 12 singles use within 1 year or 6 months for StagecoachSmart | £70 | £60 | £35 | |

London | Hillingdon

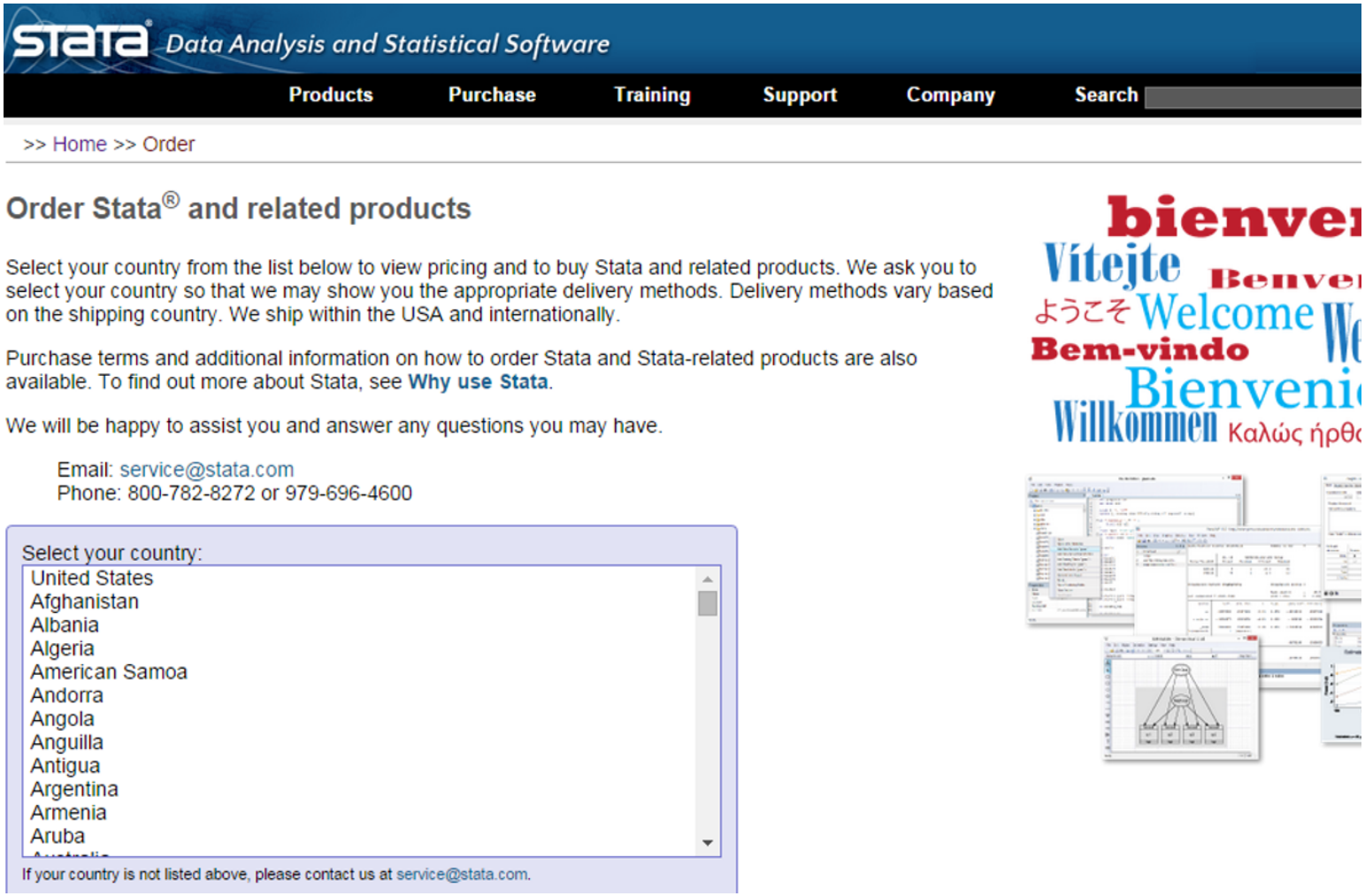
| | adult | child 5-15yrs |
|---|---|---|
| **single** one way ride | £4 | £2 |
| **return** same day or next day | £6 | £3 |
| **tube 12** 12 singles use within 1 year | £36 | |

concessionary tickets are not available between Hillingdon & London

* student of any age must show valid NUS, ISIC or official university photo ID

children under 14 must be accompanied by a responsible adult

# Is this a 1st, 2nd or 3rd degree price discrimination?

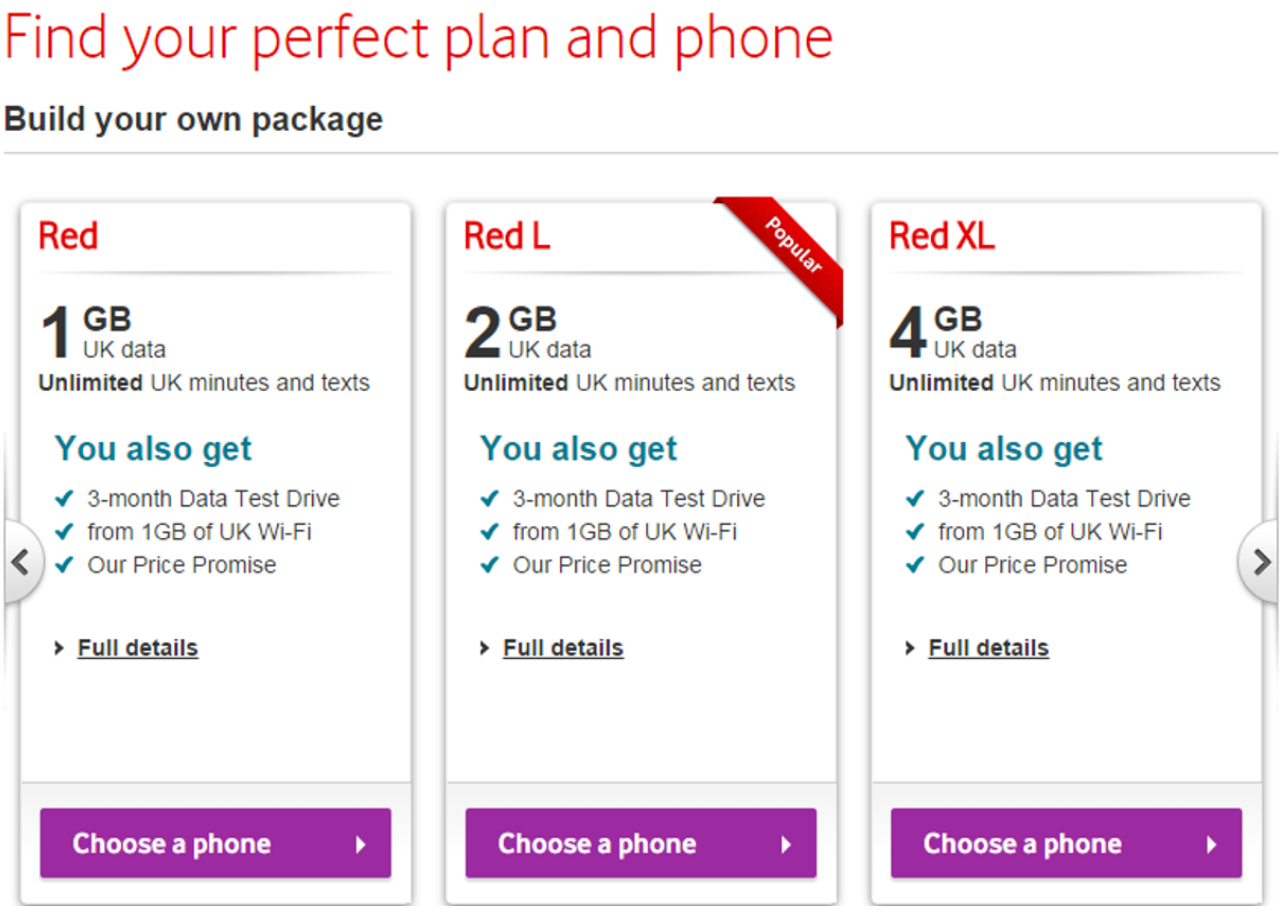



Price per a single-user STATA SE version license

- Business = \$1,695, Educator = \$895, Government = \$1,695

# Is this a 1st, 2nd or 3rd degree price discrimination?

- Different Mobile Internet Packages by Vodafone UK:



# Is this a 1st, 2nd or 3rd degree price discrimination?

- Kinokuniya Membership Card costs THB 500/year.
- Gives a 10% discount on all full priced books.

# Is this a 1st, 2nd or 3rd degree price discrimination?

- iPhone's price drops when the new model comes out.
  - iPhone6 S (pre-order $649), iPhone6 ($549), iPhone 5S ($49 with a 2-year mobile contract).

# Practice Problems

- No need to submit this homework. But these problems will help prepare you for the exams.

1. (Church and Ware) Chapter 5, problem 3.
2. (Carlton and Perloff) Chapter 4 (problem 8), Chapter 10 (Problem 1 and 5).

# Reference and Further Reading I


Carlton, D.W. and J.M., Perloff.

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