

Price Discrimination

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Introduction

Key assumption of last lecture was uniform pricing

- Everyone pays same for every unit of the good
- Drawn from competitive market, where it makes sense
 - Same marginal cost of production, so competition drives
- Much less obvious with a monopoly

⇒ Today we'll explore many alternative ways of pricing

- 1 Perfect or first-degree price discrimination
- 2 Second-degree or quantity-based price discrimination
- 3 Third degree or identity-based price discrimination
- 4 Other common forms of price discrimination
- 5 Policy applications and implications
 - When is price discrimination beneficial and when harmful?
 - Price discrimination in the design of auctions
 - Price discrimination in taxation and criminal punishment

The idea of first-degree price discrimination

First-degree price discrimination is ideal:

- 1 Charge every person personalized price
- 2 Different price for each unit sold
- 3 Match everything exactly to willingness-to-pay
 - Capture full surplus consumers gain

Rarely observed in real world (theoretical benchmark), but

- 1 Bargaining institution with very competent bargainer
- 2 Personalized pricing systems on the internet
- 3 CVS coupon systems

Best possible thing for monopolist, gets everything

- Therefore companies are always looking for better ways
- But terrible for consumers, gain no surplus
- But what about total social value?
 - Very attractive in many dimensions

Efficiency of first-degree price discrimination

First-degree price discrimination is highly efficient

- In fact, as efficient as perfect competition
 - Every consumer willing to pay above cost served
 - 1 Can't make anyone pay more than worth to them
 - 2 So charge them exactly that, for each unit
 - 3 Anytime willing-to-pay above cost, profit available
 - 4 Thus monopoly sells efficiently
 - Why does 1st degree discrimination do so well?
 - 1 Selling more doesn't require lowering price
 - 2 Seller can capture full value created
 - 3 Thus tries to maximize value created
 - However, seller captures all value
 - Consumers gain no surplus
- ⇒ Distributive issues important objection

Distributive objections and (partial) solutions

Thus perfect price discrimination often unpopular

- But more efficient...so should be possible to redistribute
- Economists advocate pairing with redistributive method
 - 1 Bidding for right to monopoly (franchise)
 - Government auction, captures all profits for other things
 - 2 Profit taxes
 - Government taxes away profits, distributes as pleases
 - 3 Labor unions
 - Unions extract profits as higher wages
- None of these solutions as perfect as it sounds
 - Redistributive authority, competitor needs to know profits
- Also may be benefits not to redistributing
 - Allows firm to capture full value created (Lecture 13)
- Lessons apply to broader price discrimination

Information and barriers to perfect discrimination

Whatever its merits, first-degree discrimination difficult

- This is why we rarely see it in practice
- Barriers to implement include?
 - 1 Administrative and “menu” costs
 - Requires quoting different price to consumers
 - Could they even process this? Predict? Plan?
 - 2 Fairness constraints
 - Many people think that price discrimination is unfair
 - Can alienate consumers
 - 3 Arbitrage and keeping track of consumers
 - Drug companies and publishers in developing countries
 - 4 Information about willingness to pay
 - Most important, how to know what to charge each?
 - Fundamentally, distortion because monopolist *uniformed*

Non-linear pricing and quantity discounts (surcharges)

Thus, in practice, price discrimination much less perfect

- One way firms commonly do this is *non-linear tariffs*
 - Different prices for different numbers of units
 - Often choice of different discrete bundles
- Examples of this (typically discount) abound?
 - 1 Bulk discounts in commercial goods
 - 2 Punch cards for loyal customers
 - 3 New York Times: free for 20 articles, charge after that
 - 4 Pricing of cloud file-sharing services
 - 5 Income taxes: rates vary depending on income level
- Goal: consumers *self-select* into right price
 - Lower price if they don't mind storing, keeping track of card
 - Lower price to those who don't value enough to use often

⇒ Not as effective, as must incentivize limited cheating

Qualities of service and multiple products

Can offer not just different *quantities* but also *qualities*

- This is very common strategy?
 - 1 Classes of service in airlines
 - 2 Qualities of rooms at a hotel
 - 3 Different levels of American Express card
 - 4 Tiers of cable and internet service
- Common observation: low-quality deliberately degraded
 - Not that the airline can't offer better service
 - Deliberately makes Coach experience bad
 - This forces those who can to pay for business, first
 - Thus monopolist distorts *quality* as well as *quantity*
 - Particularly large for low-end customers
 - Less reason to make first-class worse
 - We'll return to these issues in Lecture 14

Explicit price discrimination

Another, imperfect, approach is to group people

- Use some objective characteristic
- Charge different prices to people with these characteristics
 - ⇒ Charge higher prices to those with more elastic demand
- Most commonly used in entertainment, transportation?
 - 1 Senior, student and other discounts
 - 2 Library surcharges for journals
 - 3 Educator and public servant discounts
 - 4 Prescription drug pricing in developing world
 - 5 Home and office software licensing
 - 6 Unemployment insurance, height tax and other tagging
 - More on this below
 - 7 Resident and tourist pricing in public services
 - 8 Discounting menus in foreign languages (Chinese)

Pricing principles for explicit discrimination

Before discrimination, markets pooled; demand $\bar{Q} = Q_1 + Q_2$

- Let's derive the elasticity of pooled demand?

- Elasticity of total is $\frac{d\bar{Q}}{d\bar{p}} \frac{\bar{p}}{\bar{Q}} = \left(\frac{dQ_1}{d\bar{p}} + \frac{dQ_2}{d\bar{p}} \right) \frac{\bar{p}}{Q_1+Q_2} = \frac{Q_1\epsilon_1+Q_2\epsilon_2}{Q_1+Q_2}$

- Thus $\bar{\epsilon}$ is *quantity-weighted average elasticity*

- Lerner Rule, price absent discrimination is $\frac{\bar{p}-MC}{\bar{p}} = \frac{1}{\bar{\epsilon}}$

- After discrimination, price in each market is $\frac{p_i-MC}{p_i} = \frac{1}{\epsilon_i}$

⇒ Discrimination useful to extent that elasticities are different

⇒ Price rises in market with lower elasticity, falls in other

- We call market where rises “high” or “strong” market
- Market where price falls is “low” or “weak”

⇒ Output and social welfare may rise or fall

- Depends whether price rises more in high or falls more in low
- We'll analyze this more in a bit
- Clear: profits rise (firm's choice), high worse off, low better

Bundling, two-part tariffs and efficiency

Price discrimination takes related (more specific) forms

- Some of these achieve efficiency just like perfect
- Also transfer all value to the monopolist
- ① Bundling: two products cheaper together than apart
 - Two pieces of software free to produce: Excel and Word
 - Some people like Excel better, some Word
 - Values for the package much more homogeneous
 - Then monopolist can capture much more value in package⇒ Packaging/bundling clarifies information
- ② Extreme form is “two-part tariff”
 - Extreme form of bundling; charge for right to buy
 - Low pricing for various services, near (or below) cost
 - Rides at Disneyland, Costco, Rhapsody, etc.
 - Achieves efficiency, but takes all from consumers⇒ Just like perfect price discrimination (information perfect)

Loyalty, sales and add-ons

Other forms of discrimination less perfect, efficient

1 Loyalty and personalized discounts

- CVS and others track your purchasing
- Offer targeted discounts based on purchasing behavior
- Helps get closer to perfect, but incentives to manipulate

2 Inter-temporal (sales)

- Department, outlet stores' periodic sales/discounts
- Those whose demand is time-sensitive willing to pay a lot
- Thus discriminate by offering less to those willing to wait
- Airline ticket and hotel room pricing similar

3 Add-ons and obfuscation

- Hotels, printers, banks and others cheap to get into
 - But soak you for lots of extras once you are on board
- ⇒ Discriminate against those who don't read small print

When are prices discriminatory?

Some of these practices can be explained by costs

- 1 Peak-load pricing leads to variation across time
 - Little marginal cost of movie tickets when not full
 - Very valuable during rush times
- 2 May be cheaper to sell goods in bundles
 - Most of cost of software is the CD; cheaper to put together
- 3 Some populations cheaper to serve than others
 - Different prices for different insurance risks
 - Senior citizens less disruptive to other movie watchers

Then what makes something price discrimination?

- 1 Different prices reflect *demand* not *cost conditions*
 - This would never happen in competitive market
 - Efficiency variation even more likely in competitive
- 2 *Lack* of variation when costs vary just as discriminatory

Framework for the effects of 3rd-degree discrimination

Let's return to whether 3rd degree discrimination is good:

- 1 Does it raise output? Which price moves more?
- 2 Does it raise social welfare?
 - Might lower even with more output as valued more in High
- 3 Could it benefit consumers? Needs to raise welfare a lot

Clear: if Low unserved without discrimination, pure benefit

- If not, think about optimum before and after discrimination?
 - Before, we set $\pi'_H(\bar{p}) + \pi'_L(\bar{p}) = 0$
 - $\pi'_H(\bar{p}) > 0$ and $\pi'_L(\bar{p}) < 0$; balance each other
 - After discrimination $\pi'_H(p_H) = 0$ and $\pi'_L(p_L) = 0$
 - With constant MC, $\pi'(p) = (p - c)Q'(p) + Q(p)$
 - Exogenous competition \tilde{q} , $\pi'(p) = (p - c)Q'(p) + Q(p) - \tilde{q}$
- ⇒ Discrimination moves $\tilde{q} \equiv \pi'_H(\bar{p}) \equiv -\pi'_L(\bar{p})$ from high to low

Output and social welfare effects of discrimination

We can use this to calculate impact on output, welfare

1 Output?

- How much does change in competition affect output?
 - Last class we showed $\rho = \rho_q \equiv \frac{dq^*}{d\bar{q}}$
- Quantities thus change proportional to average ρ times \tilde{q}
- \tilde{q} same in markets, so net effect $(\bar{\rho}^L - \bar{\rho}^H) \tilde{q}$
- Thus raises output if (average) PT higher in L
 - \implies For example, if both demands linear, no effect on output
 - Could test based on discriminatory prices

2 Welfare?

- The externality is the mark-up $m \equiv p - c$
- So welfare rises if $\bar{\rho m}$ greater in low market
 - But m greater in higher market, by definition
- \implies More stringent than increasing output

Consumer surplus effects of discrimination

We can use a similar approach to measure effect on CS

- Now view move to discrimination as change in cost?
- Prior to discrimination (denote by subscript n), balance π'
- One percent price change has equal gains and losses

$$\bullet \epsilon_n^H q_n^H (MR_n^H - c) = -\epsilon_n^L q_n^L (MR_n^L - c)$$

$$\implies \Delta c^L = -\frac{\epsilon_n^H q_n^H}{\epsilon_n^L q_n^L} \Delta c^H$$

- Cost increase harms consumers equal to $\bar{\rho} \bar{q}$
 - Basic consumer surplus formula

$$\implies \text{Benefits consumers if } \bar{\rho} \bar{q}^L \frac{\epsilon_n^H q_n^H}{\epsilon_n^L q_n^L} > \bar{\rho} \bar{q}^H$$

- One natural simplification is to cancel quantities
 - $\bar{q}^L > q_n^L$, $\bar{q}^H < q_n^H$ by law of demand

$$\implies \text{If } \frac{\bar{\rho}^L}{\bar{\rho}^H} > \frac{\epsilon_n^L}{\epsilon_n^H} \text{ then raises CS; why is this more stringent?}$$

- $\frac{\bar{\rho}}{\epsilon} \approx m_d$, so $\bar{\rho}^L m_d^L > \bar{\rho}^H m_d^H$, more extreme than average

Can effects be as unpredictable as they look?

That was a bit complicated, but can be solved

- But results are a bit puzzling
- Everything seems ambiguous, depends on details
- But we know perfect price discrimination...
 - 1 Produces more and is more socially efficient
 - 2 Reduces consumer surplus
- We can also get to perfect by many 3rd-degree
 - Slice up market once, then slice up submarkets, etc.

⇒ Any given 3rd-degree ambiguous, eventually clear

- Suggests that “typical” slicing of demand falls in right way
- Simple example:
 - Segment for everyone willing-to-pay above/below x
 - If $x < \bar{p}$ don't change in high, serve low, good for all
 - If $x > \bar{p}$ serve all in high, drop price in low

⇒ Welfare increases every step, likely more accurate

Auctions and the monopoly problem

Common application of price discrimination is auction design

- Auctions very much like monopoly: set reserve price
 - 1 Higher price means less sales, but higher price
 - 2 Only difference is opportunity cost of sale
 - Determined by other buyers' willingness-to-pay
- Quantity is probability of sale, revenue is $p[1 - F(p)]$
 - F is cumulative distribution of values
- If marginal revenue decreasing, award to highest value
 - Marginal revenue is opportunity cost
- English auction a simple implementation of this
- But this assumes everyone has same marginal revenue!
- What if some sellers are more elastic?
 - This means they are expected to value less
 - Elasticity from distribution of values

Auctions, handicaps and 3rd-degree discrimination

Then you want to discriminate in favor of elastic buyers

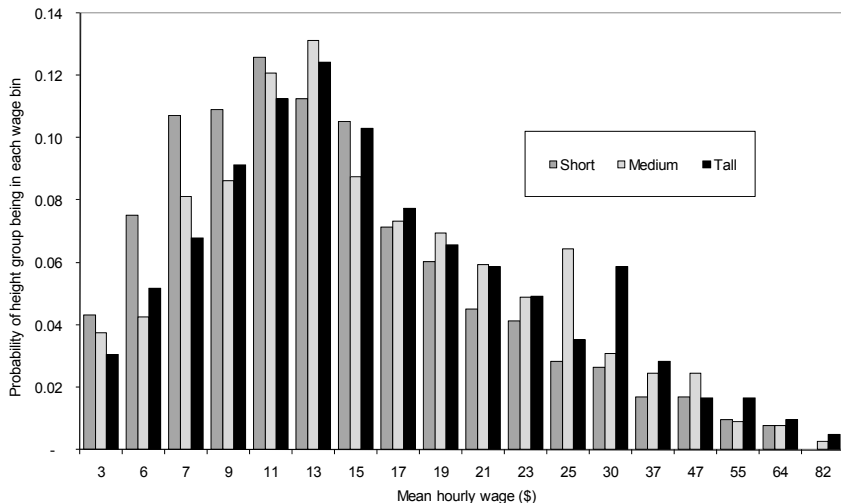
- You can give them a “handicap”
- This forces others not just to beat them by a lot
- This is beneficial intuitively because:
 - Forces bidders with higher value to admit this
 - If he only had to win by little, he would just pay low value
 - But if he has to win by a lot you can get more out of him
 - Without such discrimination, uniform reserve for everyone!
- This sort of discrimination works exactly like standard
 - 1 Compared to no discrimination, lower overall reserve
⇒ Those thought to have low values win more often when high
 - 2 High value bidders (inefficiently) win less often
 - But pay higher price, so profitable
 - 3 Similar pass-through analysis can be applied

Ideal lump sum taxes and height tax proxy

On Tuesday, we'll talk lots about redistributive taxation

- But basic goal is much like monopoly:
 - 1 Want to raise revenue to redistribute
 - From each according to ability...
 - 2 But tax on everyone discourages work, lowers revenue
- Could solve if you knew everyone's ability to earn
 - Just charge them this, don't worry about discouraging work
 - Equivalent of perfect price discrimination
- Absent this, use imperfect forms of price discrimination
 - 1 Find categories to put people
 - 2 Charge higher taxes to those with greater earning potential
 - 3 Allows more redistribution without high taxes on margin
 - 4 Exactly the same logic as 3rd-degree discrimination!
- Obvious category height: easy to observe, hard to change
 - Data shows tall earn more! Should we be taxing height?

Mankiw and Weinzierl's case for taxation of height



Broader forms of tagging

More broadly (and seriously) trade-off key in policy

- One hand: don't want to distort decisions, tax directly
- Other: if clear, price discriminations tells us to use
- Many areas of public policy can be interpreted in this way
 - 1 Affirmative action and racial preferences
 - Basing too much on income may discourage parental work
 - Cannot change their race, minorities poorer on average

⇒ Price discrimination suggests favorable treatment
 - 2 Complicated tagging and deductions in taxes
 - Aid to handicapped, single mothers, unemployed, etc.
 - If people cannot easily adjust, useful "tag" for discrimination

⇒ Economists should not instinctively oppose

- While seems to violate equity, 2nd welfare theorem...
- Actually just follow from logic of price discrimination

Intentions, situation and criminal justice

One particularly interesting instance is criminal justice

- Becker famously argued justice like monopoly problem
- Enforcement, jail time are costly, activity bad
 - Costly to police, uncompensated loss to punished
 - ⇒ Higher elasticity, more enforcement called for
- Different circumstances imply different elasticities
 - ⇒ Punishments meted out should depend on these
- Examples?
 - 1 Age of offender
 - Young get off with lighter sentence as less planning
 - 2 Degree of murder
 - More planned, more responsive it is to incentives
 - 3 Temporary insanity defense
- More general lesson about why motive, intention matters