ECN 453: Pricing and Price Discrimination 2

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Price discrimination: self-selection

- In the previous section we studied 'selection by indicators'.
  - To use selection by indicators, the seller needed information about the characteristics of consumers so they could offer different buyers different prices.
  - Often, sellers do not have much information about consumers.
  - e.g. if you're selling airline tickets online, not much information about who the high-value business travellers are.
- We will now discuss two types of **price discrimination by self-selection**.
  - These are used when the seller has no information about the characteristics of consumers.
  - Instead, the seller offers different 'deals' which cause buyers to self-select into which group they belong to.

Plan

1. Price discrimination: self-selection by versioning
2. Price discrimination: bundling

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1. **Price discrimination: self-selection by versioning**
2. Price discrimination: bundling

Self-selection: versioning

- **Self-selection by versioning**: offering different 'versions' of a product, each version targeted at a different group of consumers.

- Typical: a 'high-quality' version targeted at high-value consumers, and a 'lower-quality' version targeted at low-value consumers.

- **Examples:**

- Discount airfares with date/destination restrictions

- Iphone pro vs Iphone pro max

- Different models of Amazon Kindle

Self-selection: versioning

- An extreme form of versioning: **damaged goods** - reduce the quality of existing products
- **Example:**

Figure: 2017 Tesla Model S full range: $76 thousand

Figure: Exactly the same car with a few extra lines of code to restrict battery: $70 thousand

- Why would it be profitable for a seller to intentionally make some of its products worse? Price discrimination.

Self-selection: versioning

- Another example of damaged goods (from textbook)
- 19th century French railcars: how to prevent wealthy passengers from choosing third-class tickets rather than second-class tickets?
- Answer: pull the roof off the third-class railcar!

Self-selection: versioning, example (p131)

- **Example:**
- Two versions of product: full and stripped-down. MC = 300 for both versions.
- Two types of consumers: 1 million people of type 1; 2 million people of type 2
- Willingness-to-pay of consumers:

	full	stripped-down
type 1 (high-end)	1500	800
type 2 (low-end)	600	500

- **Questions:**
- 1. Find the profit from selling only the full version for 1500.
- 2. Find the profit from charging 1500 for full version; 500 for the stripped-down version.
- 3. Find the profit from charging 1200 for full version; 500 for the stripped-down version.

Self-selection: versioning, example

- **Solution:**

- Idea: each type of consumer will self-select into the version with the highest consumer surplus (consumer surplus=willingness-to-pay - price). E.g. consumer1 buys the full version if:

$$\text{consumer 1: } 1500 - p_{full} \geq 800 - p_{stripped-down}$$

- 1. Find the profit from selling only the full version for 1500.

  - Consumer type 1 buys the full version (receiving CS=0)

  - Consumer type 2 does not buy anything (since their CS would be 800-1500=-700 from buying the full version).

  - Then, $Profit = (1500 - 300) \times 1 \text{ million} = \$1.2 \text{ billion}$

Self-selection: versioning, example

- **Solution:**

- 2. Find the profit from charging 1500 for full version; 500 for the stripped-down version.

  - (Why are we considering this pricing? This is the pricing the seller would choose if it could practice perfect price discrimination. That is, pricing the full version at the type-1 willingness-to-pay and the stripped-down version at the type-2 willingness-to-pay.)

  - Consumer type 1: buys stripped down version (CS=0 from full version but CS=800-500=300 from the stripped-down version).

  - Consumer type 2: buys stripped down version (CS=600-1500=-900 from full version but CS=500-500=0 from the stripped-down version).

  - Then, $Profit = (500 - 300) \times 1 \text{ million} + (500 - 300) \times 2 \text{ million} = \$600 \text{ million}$

  - Profit is actually less than in part 1 when we only offered the full version. Why? Consumer type 1 now chooses the stripped-down version.

Self-selection: versioning, example

- **Solution:**
- 3. Find the profit from charging 1200 for full version; 500 for the stripped-down version.
  - Consumer type 1: buys full version (CS=1500-1200=300 from full version but CS=800-500=300 from the stripped-down version).
  - Consumer type 2: buys stripped down version (CS=600-1200=-600 from full version but CS=500-500=0 from the stripped-down version).
  - Then, $Profit = (1200 - 300) \times 1 \text{ million} + (500 - 300) \times 2 \text{ million} = \$1.3 \text{ billion}$
  - So, compared to Part 1, the seller is better off by \$100 million.

Self-selection: versioning

- Why are profits in Part 3 of the previous example higher than in Part 2?
- The reason is that the prices in Part 3 ensured that the **high-end consumer had no incentive to go for the deal that was intended for the low-end consumer.**
    - Put another way, the prices in Part 3 of the example ensured that high-end consumers self-selected into buying the high-quality version, and low-end consumers self-selected into buying the low-quality version.

Self-selection: versioning

- We can make the self-selection idea more precise. Specifically, in order to get price discrimination by self-selection to work in the previous example, prices must satisfy the following constraints:

- 'Incentive constraints': (each consumer purchases the product that is designed for them)

$$\begin{aligned} &\text{Consumer type 1:} && 1500 - p_{full} \geq 800 - p_{stripped-down} && (IC1) \\ &\text{Consumer type 2:} && 500 - p_{full} \leq 600 - p_{stripped-down} && (IC2) \end{aligned}$$

- 'Participation constraints': (price is not greater than the consumer's willingness-to-pay)

$$\begin{aligned} &\text{Consumer type 1:} && 1500 - p_{full} \geq 0 && (PC1) \\ &\text{Consumer type 2:} && 600 - p_{stripped-down} \geq 0 && (PC2) \end{aligned}$$

Self-selection: versioning - additional comment

- Typically, we assume that if a consumer is indifferent between buying two products then they choose the product the monopolist would like them to.

- Specifically, this means (for example):
  - If the 'high-end' consumer is indifferent between buying the full version and the stripped-down version (i.e. they get the same consumer surplus from both types), they buy the full version.

  - Similarly, if the 'low-end' consumer gets consumer surplus $= 0$ for the stripped-down version, then they will still buy it.

Self-selection: versioning - cookbook steps to solve

- 1. Get the consumer surplus for each product, for each consumer:

$$\text{consumer surplus} = \text{willingness to pay} - \text{price}$$

- 2. For each consumer, find the product they buy by finding the product with the highest consumer surplus

- 3. Check that consumer surplus in not negative for the products that each consumer buys
  - this amounts to checking if the 'participation constraints' hold

- 4. Compute profits given consumer choices.

Self-selection: bundling

- **Bundling**: combining products and selling them together.

- **Examples**:
- Software is bundled as a 'suite' e.g. microsoft office
- Cable tv channels
- Phone and internet plans
- Movie distribution

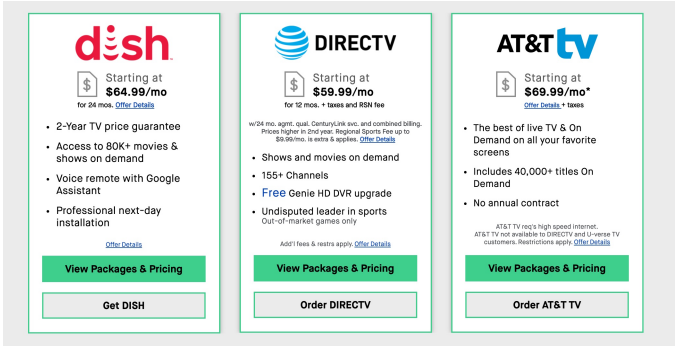

Figure: Centurylink internet bundles

Self-selection: bundling, example p133

- **Example**: Three user types: writer, number cruncher, generalist. Two products: word processor, spreadsheet. Assume $TC = 0$.

User type	**Number of users**	**Willingness to pay**	
		Word processor	Spreadsheet
Writer	40	50	0
Number cruncher	40	0	50
Generalist	20	30	30

- **Questions**:

- 1. What is the profit if each product is sold separately?

- 2. What is the profit if each product is sold separately for \$50 and a bundle of the two products is offered for \$60?

Self-selection: bundling, example p133

- Main idea: each consumer will choose (i.e. self-select into) the product/bundle with the highest consumer surplus (= willingness-to-pay - price). We need to first find the optimal price and then find the profit.

- 1. What is the profit if each product is sold separately?

- **Solution:**

- The optimal price is to charge \$50 for the word processor and \$50 for the spreadsheet.
  - Here, writers choose the word processor (and generate profit $= 50 \times 40 =$ \$2000), and number crunchers choose the spreadsheet (generating \$2000), for total profit of \$4000.

- An alternative price is to charge \$30 for both products. But, this is not optimal.
  - Both writers and generalists will choose the word processor (generating $40 \times 30 + 20 \times 30 =$ \$1800 from word processors). Similarly, \$1800 profit is made from selling the spreadsheet for a total profit of \$3600.

- (If it's not obvious, convince yourself that intermediate prices e.g. \$40 for both products, are not optimal.)

Self-selection: bundling, example p133

- 2. What is the profit if each product is sold separately for \$50 and a bundle of the two products is offered for \$60?

- **Solution:**

- Writers: choose the word processor (they could choose the bundle but they would be paying \$10 more for something they do not value). Profit from writers $= 40 \times 50 = 2000$.

- Number cruncher: choose the spreadsheet (they could choose the bundle but they would be paying \$10 more for something they do not value). Profit from number crunchers $= 40 \times 50 = 2000$.

- Generalists: choose the bundle (value the bundle at \$60, but would not want to buy a word processor or spreadsheet individually for \$50 since they only value each of these at \$30). Profit from generalists = \$1200.

- So, make \$5200 profit in total, and \$1200 more profit, from selling the bundle.

Self-selection: bundling, example p133

- Why did bundling increase profits in the previous example?
- By offering a bundle of the two products, the seller was able to:
  - get the generalist group to self-select into buying the bundle...
  - ...while still getting the writers and number crunchers to purchase products separately.
- This self-selection revealed to the seller the type of user.
  - The seller could then price-discriminate and charge a price equal to the willingness-to-pay in each group.

Self-selection: bundling, example p133

- Why did bundling increase profits in the previous example? (More on this...)
- In terms of the consumer valuations, the *negative correlation* in the valuations of writers and number crunchers for the products meant that these consumers did not buy the bundle (and so bundling worked as a price discrimination strategy).
  - For example, the writer loved the word processor but did not value the spreadsheet; the number cruncher loved the spreadsheet but did not value the word processor.
  - The generalist had a moderate valuation for each good and so bought the bundle.

Summary of key points*

- Price discrimination by self-selection is used when the seller does not have information about the exact characteristics of consumers.

- Versioning: Know how to compute the total profit (and potentially other things like consumer surplus, etc) given particular prices, using the consumer's self-selection choice.

- Bundling: Know how to compute the total profit (and potentially other things like consumer surplus, etc) given particular prices, using the consumer's self-selection choice.

*To clarify, all the material in the slides, problem sets, etc is assessable unless stated otherwise, but I hope this summary might be a useful place to start when studying the material.

Additional question: (Cabral)

- **Example**: Selling airline tickets, and there are two potential versions. Costs = 0.

Type	**Number of users**	**Willingness to pay**	
		Not Restricted	Restricted
Tourist	10	350	300
Business	10	800	400

- **Questions** What is the profit if:

- 1. We can perfectly price discriminate?

- 2. Charge \$800 for the not restricted ticket, \$300 for the restricted ticket?

- 3. Charge \$700 for the not restricted ticket, \$300 for the restricted ticket?

- 4. Explain why the profits in Part 4 are greater than Part 3.

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Tourist	10	350	300
Business	10	800	400

- **Questions** What is the profit if:

- 1. We can perfectly price discriminate? A: 11500

- 2. Charge $800 for the not restricted ticket, $300 for the restricted ticket? A: 6000

- 3. Charge $700 for the not restricted ticket, $300 for the restricted ticket? A:10000

- 4. Explain why the profits in Part 4 are greater than Part 3. A: The incentive constraint for the high types is violated in part 3.