

Price Discrimination Outline

Price Discrimination

- Price Discrimination
- Monopoly First-Degree Price Discrimination
- Monopoly Second-Degree Price Discrimination
 - Bulow Durable Goods Model
 - Pure Bundling
 - Mixed Bundling
 - Interrelated Products
 - Correlated Valuations
 - Many Goods
- Monopoly Third-Degree Price Discrimination
 - Katz Intermediate Goods Model
- Oligopoly Third-Degree Price Discrimination

Price Discrimination

- Definition: Price discrimination describes the practice under which a firm sells the same good at different prices, or, more generally, "when two or more similar goods are sold at prices that are in different ratios to marginal costs". (Varian, 1989)
- Necessary Conditions: No arbitrage, market power, ability to sort or classify customers.
- Incentive: Capture surplus of consumers who previously pay price below valuation, or who previously do not buy.

Monopoly First-Degree Price Discrimination

- Definition: Sell to each customer at price equal to valuation.
- Necessary Conditions: No arbitrage, complete market power, perfect knowledge of valuations, complete bargaining power.
- Analysis: Explain why $MR = v$.
- Result: Social surplus maximised and entirely captured by firm.
- Evaluation: Critical assumption of perfect knowledge is unrealistic because consumers have no incentive to truthfully disclose valuations.
- Evaluation: Critical assumption of complete bargaining power is unrealistic because the firm has incentive to renegotiate.

Monopoly Second-Degree Price Discrimination

- Definition: Offer a common menu of non-linear packages such that consumers self-select.
- Necessary Conditions: No arbitrage, market power, knowledge of distribution of valuations.
- Parameters: Zero marginal cost, half of consumers large, half small.
- Analysis: Explain incentive compatibility constraint and illustrate with first-degree price discrimination example. Explain incentive to distort small package. Analyse graphically.
- Result: Small consumers buy distorted package, enjoy zero surplus. Large consumers buy undistorted package, enjoy positive surplus. Firm enjoys large profit.
- Discussion: Model can be interpreted in terms of quality.
- Case Study (Passenger Rail):
 - Passengers in third class on passenger rail in the 1800s sat on wooden benches in open carriages while passengers in second class enjoyed upholstered seats in closed carriages. The conditions in third class were not primarily a cost-saving measure, and were instead aimed at making third class travel sufficiently unattractive for passengers who could afford to travel in second class. Rail companies "hit the poor, not because they want to hurt them, but to frighten the rich".
- Case Study (IBM Printers):
 - IBM sold a printer in two versions, a primary version which printed twelve pages per minute, and a secondary version that was handicapped such as to only print eight pages per minute. The two printers were otherwise identical. The

objective of this handicapping, presumably, is to enable IBM to sell to mid-market customers at a lower price without also having to sell to more affluent customers at the lower price. By handicapping the printer, IBM made the low-end model sufficiently unattractive for affluent customers.

Bulow Durable Goods Model

- Motivation: Intertemporal price discrimination is complicated by inability to credibly commit to price-time packages.
- Parameters: Firm chooses p_1 then p_2 to maximise $\Pi = \pi_1 + \pi_2$, individual consumer surplus is given by $2v - p_1$ or $v - p_2$, where $v \sim U(0, 1)$.
- Analysis: Suppose $p_1 = p_2 = p$, then find indifferent consumer, hence demand function and profit function. Solve by taking FOC. Suppose not necessarily $p_1 = p_2 = p$, solve by backward induction.
- Result: $\downarrow \Pi$ where price discrimination is practicable.
 - Intuitively, consumers with intermediate valuations anticipate a price decrease and withhold consumption, hence the firm sells to these consumers at a lower price, and partially offsets this by choosing a lower first-period price.

Pure Bundling

- Discussion: Counts as second-degree price discrimination since $p_{A+B} \neq p_A + p_B$.
- Parameters: Firm has zero marginal cost, chooses p_A and p_B , or chooses p_{A+B} , consumers have $v_A, v_B \sim U(0, 1)$, $v_A \perp\!\!\!\perp v_B$ and $v_{A+B} = v_A + v_B$.
- Analysis: Find indifferent consumer, hence demand function and profit function, then solve by taking FOC.
- Result: $\uparrow \Pi$ under pure bundling.
 - Analytically, valuations are more concentrated around the mean, hence demand is more price-elastic and the firm captures a greater share of consumer surplus.
 - Intuitively, the firm "forces" consumers who otherwise buy only one product to buy both.
- Result: $\uparrow CS \Rightarrow \uparrow W$.
 - Intuitively, the firm has incentive to $\downarrow p, \uparrow q \Rightarrow \uparrow W$. Some consumers are better off, others worse off. Positive output effect dominates negative misallocation effect.

Mixed Bundling

- Parameters: Firm has zero marginal cost, chooses p_A, p_B, p_{A+B} , consumers have $v_A, v_B \sim U(0, 1)$, $v_A \perp\!\!\!\perp v_B$ and $v_{A+B} = v_A + v_B$.
- Result: $\uparrow p_{A+B}$ compared to pure bundling.
 - Intuitively, $\uparrow p_{A+B}$ diverts some consumers to A, B , and $p_A, p_B > c = 0$ hence \uparrow incentive to $\uparrow p_{A+B}$.
- Result: $\uparrow p_A, p_B$ compared to separate selling.
 - Intuitively, $\uparrow p_A, p_B$ diverts some consumers to $A + B$ and $p_{A+B} > 2c = 0$ hence \uparrow incentive to $\uparrow p_A, p_B$.
- Result: $\uparrow \Pi$ compared to pure bundling and separate selling.
 - Analytically, mixed bundling "envelops" pure bundling and separate selling.
 - Intuitively, the firm enjoys larger margin on bundle and positive margin on consumers who buy only one good.
- Result: $CS^p > CS^m > CS^s$.

Interrelated Products

- Parameters: If substitutes, $v_{A+B} < v_A + v_B$. If complements, $v_{A+B} > v_A + v_B$.
- Result: \uparrow complementarity $\Rightarrow \downarrow$ effect of bundling.
 - Intuitively, fewer consumers demand only one product and more consumers demand both. In the extreme, bundling is equivalent to separate selling.

Correlated Valuations

- Parameters: $cov(v_A, v_B) \neq 0$.
- Result: $\downarrow cov(v_A, v_B) \Rightarrow \uparrow \Pi$.
 - \downarrow correlation $\Rightarrow \uparrow$ concentration of valuation for the bundle $\Rightarrow \uparrow$ price-elasticity of demand $\Rightarrow \uparrow$ share of consumer surplus captured.

Many Goods

- Parameters: Firm produces more than two products.
- Result: $\uparrow \Pi$, W due to bundling.
 - Intuitively, by LLN, \uparrow concentration of valuation for the bundle $\Rightarrow \uparrow \Pi, q$.

Monopoly Third-Degree Price Discrimination

- Definition: Offer different consumers different linear price schedules on the basis of an exogenous signal.
- Necessary Conditions: No arbitrage between sub-markets, market power, exogenous signal.
- Parameters: Firm chooses p_A for high-valuation low-elasticity consumers, p_B for low-valuation high-elasticity consumers, to maximise $\Pi = \pi_A + \pi_B$.
- Analysis: Given no arbitrage, sub-markets are independent, $\arg \max_{p_A, p_B} \Pi = \arg \max_{p_A} \pi_A, \arg \max_{p_B} \pi_B$. By taking FOC for q_A, q_B , show $p_A > p_B$.
- Result: $\uparrow \Pi$ compared to linear pricing.
 - Intuitively, the firm chooses a more optimal price in each sub-market, $\uparrow \pi_A, \pi_B$.
- Result: Welfare effect ambiguous.
 - Intuitively, the firm is better off, large consumers are worse off, and small consumers are better off. Misallocation and output effects compete. Given linear comparably-sized demand, output is unchanged.
 - Analytically, Aguirre et al. (2016) find that welfare increases if demand in the low-price market is more convex.
 - Analytically, if discrimination opens a new market, there is no misallocation effect since the firm treats high-price market independently regardless.
- Discussion: Distributive effects ambiguous because surplus is transferred from consumers to producers but also from low-elasticity (generally high income) consumers to high-elasticity (generally low income) ones.
- Discussion: Model interpretable in temporal terms by taking time as the exogenous signal.

Katz Intermediate Goods Model

- Motivation: The simple model of third-degree price discrimination translates poorly to intermediate goods markets because of demand interdependence and the possibility of backward integration.
- Parameters: U produces at c and chooses w_C, w_L , C chooses whether to backward-integrate at cost F , then C and L compete in Cournot. C produces at c_C if it backward-integrates.
- Analysis: If U induces (or does not deter) backward integration regardless of whether discrimination is practicable, practicability of discrimination is irrelevant. If U deters backward integration only if discrimination is practicable, backward integration may be socially inefficient due to F and externalities on L and U . If U always deters backward integration, it chooses higher w_L , under some conditions, integration incentive decreases, U chooses higher w_C until integration constraint is again binding.

Oligopoly Third-Degree Price Discrimination

- Parameters: Standard Hotelling model with fixed locations and linear transport cost, except each firm chooses $p_X(x)$.
- Analysis: Show no profitable deviation from Nash equilibrium in individual-consumer game for $x \in [0, \frac{1}{2})$. Generalise.
- Result: $\downarrow p(x)$ for $x \in (0, 1) \Rightarrow \uparrow CS, \downarrow \pi; \nearrow W$.
 - Intuitively, each consumer is an independent sub-market where demand is perfectly elastic. Under non-discrimination, there is less incentive to decrease price because of decrease in profit on infra-marginal units.