Monopoly
Set 2

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April 21, 2021

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Non-linear Price Discrimination

Also known as, Second Degree Price Discrimination

Discrimination based on unobservable characteristics by offering a menu of contracts.

- Differential prices are charged by blocks of services.
- It requires metering of services consumed by buyers.
- Per-unit price depends on units consumed.
- Buyers self-select various menus.
- Examples: two-part pricing plans, block pricing

Block Pricing

- A firm charges one price per unit for the first block purchased and a different price per unit for subsequent blocks. Used by utility firms.
- When block pricing, CS is lower, TS is higher and deadweight loss is lower.
- The firm and society are better off but consumers lose.
- The more block prices that a firm can set, the closer the firm gets to perfect price discrimination.

Firm's Optimization Problem

- Assuming that firm's tariff consists only of two blocks, let Q_1 and $Q_2 - Q_1$ denote the size of each blocks.
- The firm's optimization problem is

$$\max_{Q_1, Q_2} P_1(Q_1)Q_1 + P_2(Q_1, Q_2)(Q_2 - Q_1) - TC(Q_1, Q_2)$$

- Differentiating with respect to Q_1, we get

$$\underbrace{P_1 + \frac{dP_1}{dQ_1}Q_1}_{MR_1} + \frac{dP_2}{dQ_1}(Q_2 - Q_1) + P_2\frac{d(Q_2 - Q_1)}{dQ_1} = \frac{dTC}{dQ_1}$$

- $\implies Q_1 < Q_M$ where Q_M denotes the price charged by single pricing firm.
- Differentiating with respect to Q_2, we get

$$\underbrace{P_2 + \frac{dP_2}{dQ_2}Q_2}_{MR_2} = \frac{dTC}{dQ_2}$$

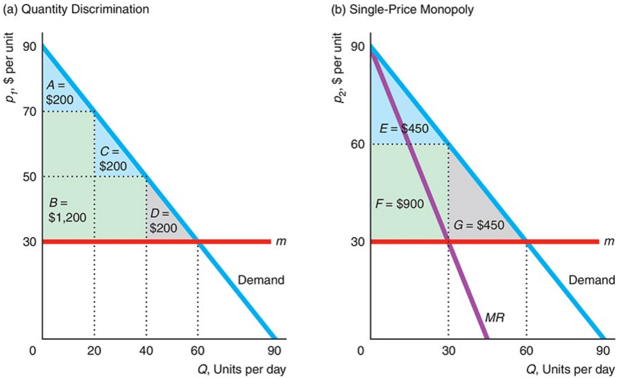
Practice Problem

Softco is a software company that sells a patented computer program to businesses. Each business it serves has the demand for Softco's product:

$$P = 90 - Q$$

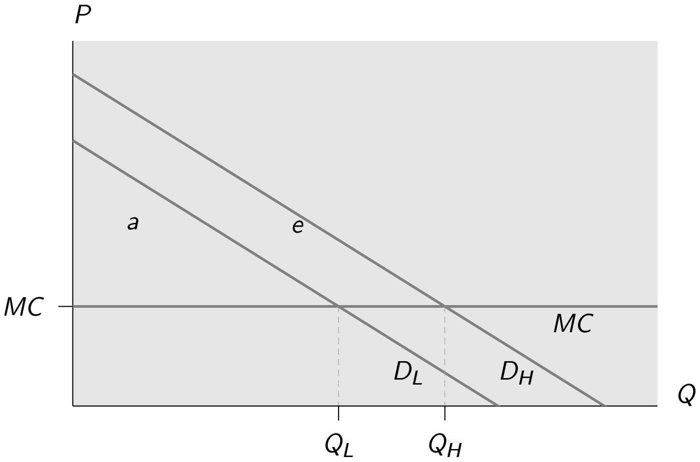
The marginal cost for each program is \$30. Assuming that there are no fixed costs, answer the following questions:

1. If Softco sells its program at a uniform price, what price would maximize profit? How many units would it sell to each business customer? How much profit would it earn from each business customer?
2. Suppose that Softco were to sell the first block at the price you determined in part (a), and that the quantity for that block is the quantity you determined in part (a). Find the profit-maximizing quantity and price per unit for the second block. How much extra profit would Softco earn from each of its business customers?
3. Do you think Softco could earn even more profits with a set of prices and quantities for the two blocks different from those in part (b)?



	Block Pricing	Single Price
Consumer Surplus, *CS*	$A + C = \$400$	$E = \$450$
Producer Surplus or Profit, $PS = \pi$	$B = \$1,200$	$F = \$900$
Total Surplus, $TS = CS + PS$	$A + B + C = \$1,600$	$E + F = \$1,350$
Deadweight Loss, *DWL*	$D = \$200$	$G = \$450$

Two-part pricing with differing consumers



Is it still optimal for the firm to charge a price equaling its marginal cost and fixed fee equaling the consumer surplus?

Two-part pricing with differing consumers

With MC pricing, firm has two options for fixed fee:

- Option 1: Charge a fixed fee that captures entire surplus received by consumer H

$$F_H = \int_0^{Q_H^*} v_A(Q_H) - MC \times Q_H$$

Only consumer H buy the good and total profits equals F_H.

- Option 2: Charge a fixed fee that captures entire surplus received by consumer L

$$F_L = \int_0^{Q_L^*} v_L(Q_L) - MC \times Q_L$$

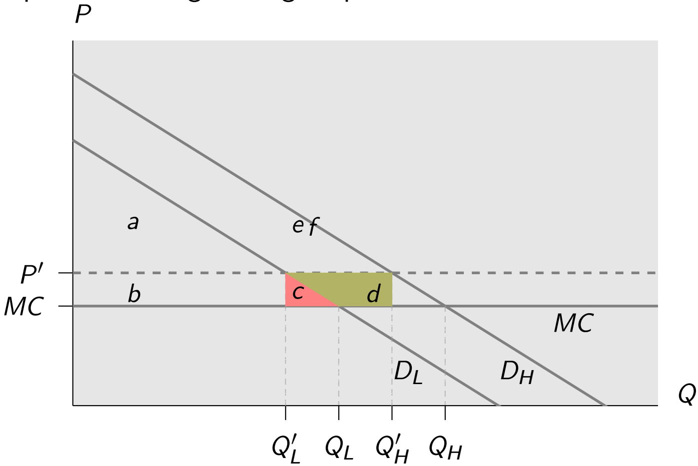
Both consumers buy the good and total profits equals $2F_L$.

- If $F_H > 2F_L$, then the monopolist find it optimal to see a high fixed fee and exclude consumer B from the market.

- If $F_H < 2F_L$, monopolist with marginal-cost pricing serves both consumers.

Two-part pricing with differing consumers

Option 3: Charges a higher price $P' > MC$ and a lower fixed fee.



- Monopolist gains d from consumer H but loses c from consumer L.
- Profits are increased by charging $P > MC$.

Summary: Monopolist's options under two-part pricing

- **Option 1:** $P = MC$ and Fixed fee: $a+b+c+d+e+f$.

$$\begin{aligned}
\text{Total Revenue} &= \underbrace{a+b+c+d+e+f}_{\text{Fixed Fee}} + (P \times Q_H) \\
\text{Total Cost} &= (MC \times Q_H) \\
\text{Profits} &= \underbrace{a+b+c+d+e+f}_{\text{Fixed Fee}}
\end{aligned}$$

- **Option 2:** $P = MC$ and Fixed fee: $a+b+c$.

$$\text{Profits} = 2 \times \underbrace{a+b+c}_{\text{Fixed Fee}}$$

- **Option 3:** $P > MC$ and Fixed fee: a.

$$\begin{aligned}
\text{Profits} &= 2 \times \underbrace{a}_{\text{Fixed Fee}} + (P - MC) \times Q'_H + (P - MC) \times Q'_L \\
&= \underbrace{2a}_{\text{Fixed Fee}} + \underbrace{b+c+d}_{\text{Sale to H}} + \underbrace{b}_{\text{Sale to L}}
\end{aligned}$$

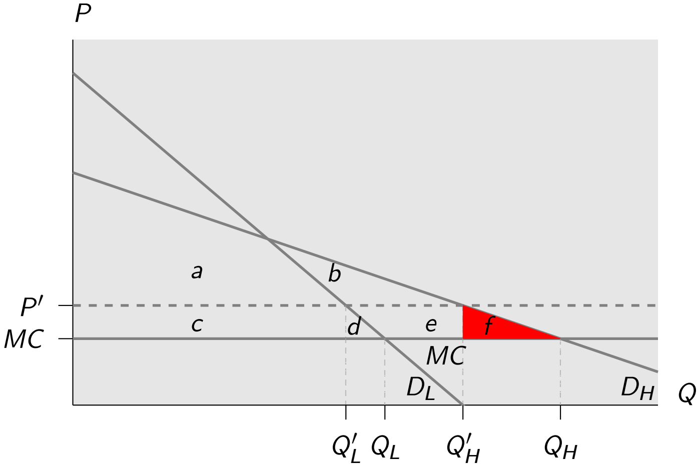
Practice Problem

Consider a market consisting of two kinds of consumers:

$$
\begin{aligned}
Q_A &= 5 - P \\
Q_B &= 10 - 2P
\end{aligned}
$$

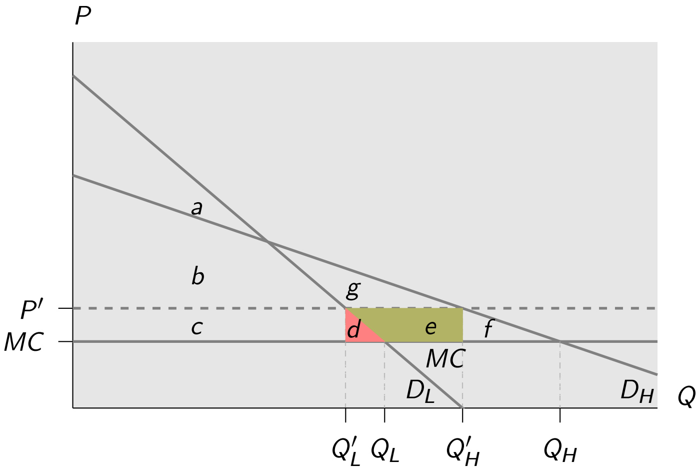
- What is the firm's optimal two-part pricing plan if it caters to only one kind of consumers? Which kind of consumers will the firm find it optimal to serve?
- What is the firm's optimal two-part pricing plan if it caters to both kind of consumers?

Two-part pricing with $P = MC$ & Fee$=CS_H$



- Possibility 1: At marginal cost pricing, optimal fixed fee is $CS_H = a + b + c + d + e + f$.
- Raise prices $\rightarrow$ lower fixed fee of $(a + b)$,
  - variable revenue $c + d + e$ (from H).
  - lose f (from H).

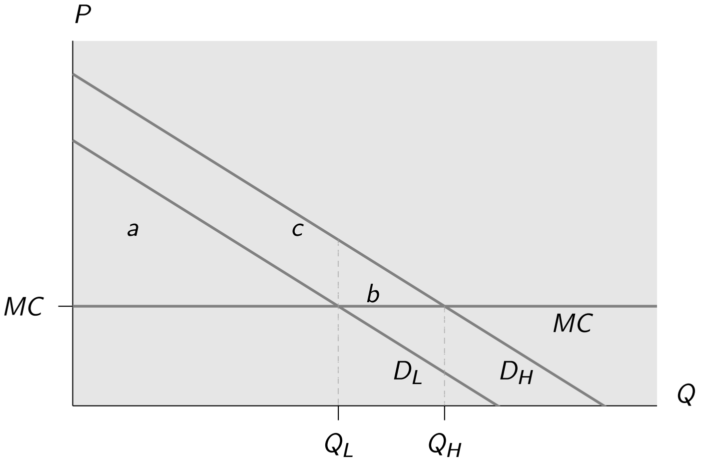
Two-part pricing with $P = MC$ & Fee$=CS_L$



- Possibility 2: At marginal cost pricing, optimal fixed fee is $CS_L = a + b + c + d$.
- Raise prices $\rightarrow$ lower fixed fee of $a + b$,
  - variable revenue c(from L) and $c + d + e$ (from H).
  - lose d (from H) and gain e (from L).

What if firm can offer different "menus" to different consumers and allow consumers to *self-select*?

- Offer (Q_H, T_H) to consumer H and (Q_L, T_L) to consumer L where T denotes a fixed fee/transfer from consumer to producer



Option 1: Offer a menu with competitive outputs and fee that equals consumer surplus for each consumer.

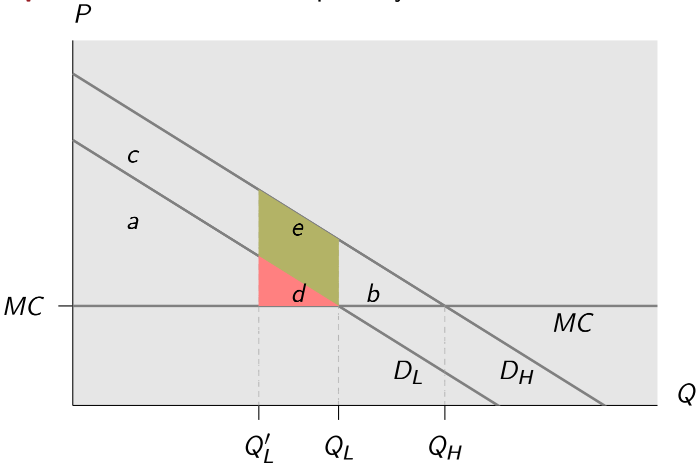
- Consider a menu that captures consumer surplus from both consumers, that is, $(Q_L,\ a)$ and $(Q_H, a+b+c)$.
- Consumer H will have incentive to pick $(Q_L,\ a)$ and earn a positive consumer surplus c.
- Consumer H will be discouraged to pick $(Q_L,\ a)$ if he can earn a consumer surplus c or higher from his own menu.

Option 2: Offer a menu with competitive outputs, but leaves consumer H indifferent between the two menus.

- If consumers are offered $(Q_L,\ a)$ and $(Q_H, a+b)$, both consumers will pick menus designed for them.
- Question: If $(Q_L,\ a)$ and $(Q_H, a+b)$ profit maximizing menu?

Menu Pricing

Option 3: Offer a lower quantity to consumer L.



- Monopolist gains $d + e$ from consumer H but loses d from consumer L.
- Profits are increased by offering $Q'_L < Q_L$.

Menu Pricing

Optimal menu-pricing exhibits following properties:

1. The relevant constraint for the firm is to prevent high-demand consumers from picking the menu offered for low-demand consumers.
2. Low-demand consumers receive zero consumer surplus, while high-demand consumers receive positive surplus.
3. High-demand consumers are offered a socially optimal quantity, while low-demand consumers are offered a sub-optimal quantity.

Example: Menu Pricing

- Suppose consumers preferences are captures by a taste parameter $\theta > 0$.
  - For simplicity, θ takes only two values: $\theta \in \{\theta_H, \theta_L\}$ where $\theta_H > \theta_L > c$.
- Consumer's preferences are given by the following quasi-linear utility function:

$$U(\theta, q, T) = V(\theta, q) - T$$

  if he buys $q > 0$ units and pays T.
- Consumer's reservation option (utility if $q = 0$ is 0).
- Further, it is assumed that utility is increasing in q and θ.

$$V(\theta, 0) = 0, V_q(\theta, q) > 0, V_\theta(\theta, q) > 0$$

- Also, marginal utility is decreasing in q increasing in θ.

$$V_{qq}(\theta, q) < 0, V_{\theta q}(\theta, q) > 0$$

- Suppose firm has constant marginal costs of production c.

Example Contd.: Menu Pricing

Monopolist chooses (q_H, T_H) and (q_L, T_L) to maximize

$$T_H - cq_H + T_L - cq_L$$

such that the following constraints are met:

1. Participation/Individual Rationality Constraints

$$\begin{aligned} V(\theta_H, q_H) - T_H &\geq 0 \text{ —— } (IR_H) \\ V(\theta_L, q_L) - T_L &\geq 0 \text{ —— } (IR_L) \end{aligned}$$

2. Truth-telling/Incentive Compatibility Constraints

$$\begin{aligned} V(\theta_H, q_H) - T_H &\geq V(\theta_H, q_L) - T_L \text{ —— } (IC_H) \\ V(\theta_L, q_L) - T_L &\geq V(\theta_L, q_H) - T_H \text{ —— } (IC_L) \end{aligned}$$

- If IR_L is satisfied, then IR_H will be too.
- IC_L will be satisfied in equilibrium.
- IR_L and IC_H are the two binding conditions.

Example Contd.: Menu Pricing

- Monopolist chooses (q_H, q_L) such that

$$\max_{q_H, q_L} V(\theta_H, q_H) - V(\theta_H, q_L) + V(\theta_L, q_L) - cq_H + V(\theta_L, q_L) - cq_L$$

- Differentiating with respect to q_H yields

$$V_{q_H}(\theta_H, q_H) = c$$

- Differentiating with respect to q_L yields

$$V_{q_L}(\theta_L, q_L) = \frac{c + V_{q_L}(\theta_H, q_L)}{2} > c$$

Key Takeaway

The optimal contract involves offering a socially optimal quantity to high-demand consumers and a sub-optimal quantity to low-demand

Example Contd: Menu Pricing

Assume the following functional form for consumer utility:

$$V(\theta, q) = \theta q - \frac{q^2}{2}$$

Then

- $V_q(\theta, q) = \theta - q$.
- Plugging this back in the conditions derived on last slide, we get optimal quantities as:
  1. $q_H^* = \theta_H - c$
  2. $q_L^* = 2\theta_L - \theta_H - c$
- The corresponding fees are given by:
  1. $T_H = V(\theta_H, q_H^*) - V(\theta_H, q_L^*) + V(\theta_L, q_L^*)$
  2. $T_L = V(\theta_L, q_L^*)$.
- $CS_L = 0$ and $CS_H = V(\theta_H, q_L^*) - V(\theta_L, q_L^*)$.

Example Contd.: Uniform pricing

- Suppose monopolist sets a uniform price p, then consumer's optimization problem becomes:

$$\max_q V(\theta, q) - pq$$

and yields

$$p = V_q(\theta, q)$$

- This condition yields consumer's demand function.
- Given the assumed functional form:

$$V(\theta, q) = \theta q - \frac{q^2}{2}$$

  - Consumer demand function is then given by: $q = \theta - p$
  - Consumer surplus is $CS(\theta, p) = \frac{(\theta - p)^2}{2}$
  - Consumer Surplus is increasing in θ.

Example Contd.: Uniform Pricing

- Suppose firm has constant marginal costs of production c.
- θ takes only two values: $\theta \in \{\theta_H, \theta_L\}$ where $\theta_H > \theta_L > c$.
- Monopolist chooses P to maximize:

$$(P - c)(\theta_H - P) + (P - c)(\theta_L - P)$$

- Solving this yields optimal pricing as:

$$P^U = \frac{\theta_H + \theta_L + 2c}{4} > c$$

Key Takeaways

Profit maximization entails a monopolist charging a price above its marginal cost.

Example Contd.: Two-part tariffs

- Monopolist chooses P to maximize:

$$(\theta_L - P)^2 + (P - c)(\theta_H - P) + (P - c)(\theta_L - P)$$

- Solving this yields optimal pricing as:

$$P^T = c + \frac{\theta_H - \theta_L}{2} > c$$

and corresponding fixed fee of

$$F = \frac{1}{2}\left(\frac{(3\theta_L - \theta_H - c)}{4}\right)^2 < CS_{\theta_L}(c)$$

- Comparing P^U and P^T reveals that

$$P^U > P^T \text{if and only if } 3\theta_L - \theta_H > 2c$$

that is, two types are "very similar" to each other.

Welfare Implications

- Welfare Implications
  - U.S. antitrust laws look unfavorably at the practice of price discrimination, which is said to lead to a lessening of competition.
  - Often, the welfare implications are uncertain because it is difficult to weigh the benefits bestowed on consumers with lower prices compared with the costs imposed on consumers paying higher prices.

Quality Discrimination

- Monopolist can also discriminate among consumers by offering products of differing qualities.
- Quantity discrimination is very similar to quantity discrimination.
- Monopolist uses lower quality goods for market segmentation by offering a sub-optimal quality to θ_L consumers.

Dupuit (1849)

It is not because of the few thousand francs which would have to be spent to put a roof over the third-class carriages or to upholster the third-class seats that some company or other has open carriages with wooden benches...What the company is trying to do is to prevent the passengers who can pay the second-class fare from traveling third-class; it hits the poor, not because it wants to hurt them, but to frighten the rich....

Multiproduct Pricing

When the firm produces two or more products and exercises monopoly power in both markets

- Related on demand side
  - Complements in consumption: products are complements in terms of demand, an increase in the quantity sold of one will bring about an increase in the quantity sold of the other
  - substitutes in consumption: products are substitutes in terms of demand, an increase in the quantity sold of one will bring about a decrease in the quantity sold of the other
- Related on supply side
  - Complements in production: products are joined in production, products produced from one set of inputs
  - Substitutes in production: products compete for resources, using resources to produce one product takes those resources away from producing other products

Multiproduct Pricing: Demand Interrelationships

Consider two products A and B with dependent demand curves such that

$$Q_A = f(P_A, P_B), Q_B = g(P_A, P_B)$$

Then

$$TR = TR_A + TR_B = P_A Q_A + P_B Q_B$$

Total costs are dependent on both Q_A and Q_B.

Profit maximization requires choosing Q_A and Q_B such that

$$MR_A = MC_A \text{ and } MR_B = MC_B$$

Multiproduct Pricing: Demand Interrelationships

- What is the marginal revenue from an additional unit of good A?

$$MR_A = \frac{\partial TR_A}{\partial Q_A} + \frac{\partial TR_B}{\partial Q_B} . \frac{\partial Q_B}{\partial Q_A}$$

  - The first term captures the direct effect on revenue through own-prices.
  - The second term captures indirect effect on revenue through prices of other product.

- How is a marginal cost of production calculated?

$$MC_A = \frac{\partial TC}{\partial Q_A} + \frac{\partial TC}{\partial Q_B} . \frac{\partial Q_B}{\partial Q_A}$$

  - The first term captures the direct effect on costs of changing Q_A.
  - The second term captures the indirect effect due to a change in prices (and production) of other products.

- Both direct and indirect effects should be considered while determining the optimal level of production.

Multi-product pricing: Dependent demand, Separable costs

- Suppose production costs are additive, that is, $TC(Q_A, Q_B) = TC_A(Q_A) + TC_B(Q_B)$.
- Then the profit maximization condition $MR_A = MC_A$ yields:

$$
\begin{aligned}
\underbrace{P_A + Q_A \frac{\partial P_A}{\partial Q_A} + P_B \frac{\partial Q_B}{\partial Q_A}}_{MR_A} &= \underbrace{\frac{dTC_A}{dQ_A} + \frac{dTC_B}{dQ_B} \frac{\partial Q_B}{\partial Q_A}}_{MC_A} \\
P_A - MC_A\left(Q_A\right) &= -Q_A \frac{\partial P_A}{\partial Q_A} - \left(P_B - MC_B\left(Q_B\right)\right) \frac{\partial Q_B}{\partial Q_A} \\
\frac{P_A - MC_A\left(Q_A\right)}{P_A} &= -\frac{Q_A}{P_A} \frac{\partial P_A}{\partial Q_A} - \frac{\left(P_B - MC_B\left(Q_B\right)\right)}{P_A} \frac{\partial Q_B}{\partial Q_A} \\
&= \frac{1}{\left|E_D^A\right|} - \frac{\left(P_B - MC_B\left(Q_B\right)\right)}{P_A} \frac{\partial Q_B}{\partial Q_A}
\end{aligned}
$$

Multi-product pricing: Dependent demand, Separable costs

Consider

$$\frac{\partial Q_B}{\partial Q_A} = \frac{\partial Q_B}{\partial P_A}\frac{\partial P_A}{\partial Q_A}$$

- $\frac{\partial P_A}{\partial Q_A} < 0$ due to Law of Demand.

$$\frac{\partial Q_B}{\partial Q_A} \overset{sign}{=} -\frac{\partial Q_B}{\partial P_A}$$

- If two good are substitutes, $\frac{\partial Q_B}{\partial P_A} > 0$, then

$$\frac{P_A - MC_A\left(Q_A\right)}{P_A} > \frac{1}{\left|E_D^A\right|}$$

  Lerner index exceeds the inverse of (own-)price elasticity of demand.
- If the firm is decomposed into two separate divisions, each responsible for its own profits, each division charges "too low" a price from the point of view of aggregate profit maximization.
- Incentives should be provided to raise the prices.

Multi-product pricing: Dependent demand, Separable costs

- If two good are complements, $\frac{\partial Q_B}{\partial P_A} < 0$, then

$$\frac{P_A - MC_A\left(Q_A\right)}{P_A} < \frac{1}{\left|E_D^A\right|}$$

  Inverse of (own-)price elasticity of demand exceeds Lerner index.

- If the firm is decomposed into two separate divisions, each responsible for its own profits, each division charges "too high" a price from the point of view of aggregate profit maximization.

- Incentives should be provided to lower the prices.

- The firm may have incentives to sell some of their goods below their marginal costs so as to raise the demand for other goods.

Application: Inter-temporal Pricing and Goodwill

- Consider a monopoly producer of a single good that is sold in two consecutive time periods: 1 and 2.
- In period 1: $Q_1^D = f(P_1)$ where $f_{P_1} < 0$.
- In period 2: $Q_2^D = g(P_1, P_2)$ where $g_{P_1}, g_{P_2} < 0$.
- There is "goodwill effect" in the sense that lowering prices in period 1 raise demand in both period 1 and 2.
- In each period, costs are dependent on the quantity produced in that period only.
- Monopolist's profits are given by:

$$P_1 Q_1^D(P_1) + P_2 Q_2^D(P_1, P_2) - C(Q_1) - C(Q_2)$$

- While Q_2 should be such that

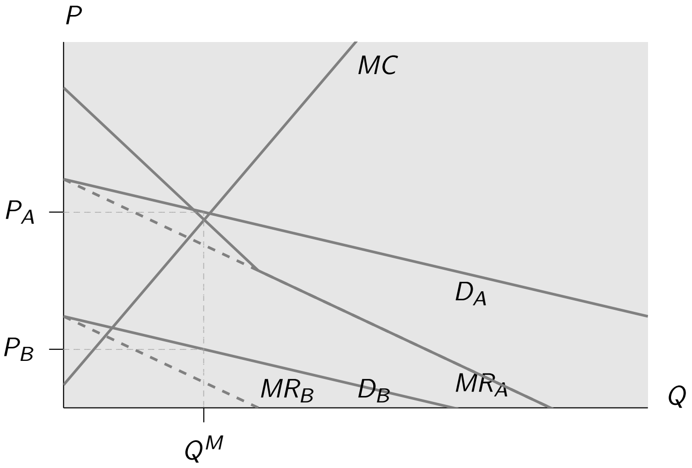
$$\frac{P_2 - MC_2(Q_2)}{P_2} = \frac{1}{|E_D|} \text{ (monopoly pricing)}$$

- Q_1 should increase $\rightarrow$ Lower prices today to raise demand tomorrow.

Multiproduct Pricing: Production Interrelationships

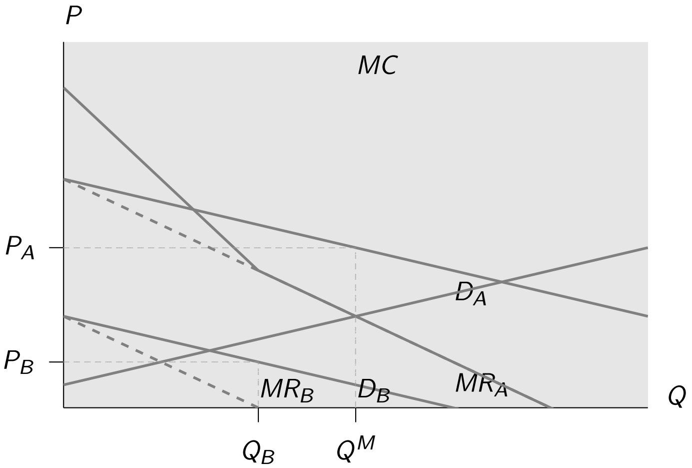
- Consider two products A and B that are produced using same resources and in same proportion.
- Total Marginal Revenue is obtained by adding the individual marginal revenue.
- Optimal output is determined by comparing the total marginal revenue to marginal cost.

Multiproduct Pricing: Complements in production



Produce and sell Q^M in both markets for prices P_A and P_B respectively.

Multiproduct Pricing: Complements in production



Sell $Q_B < Q^M$ in market B. "Surplus" amount of good B must be kept off market to avoid depressing its price.

Multiproduct Pricing: Substitutes in production

- Consider two goods A and B that are substitutes in production.
- They compete for the same resources and can be produced in variable proportions.
- A firm maximizes profit by producing the combination that yields maximum revenue for a given cost.

Bundling

- Firms with market power often pursue a pricing strategy called bundling.
- Bundling consist of selling multiple goods or services for a single price.
- Most goods are bundles of many separate parts.
- However, firms sometimes bundle even when there are no production advantages and transaction costs are small.
- Bundling allows firms to increase their profit by charging different prices to different consumers based on the consumers' willingness to pay.
  - Pure bundling: only a package deal is offered (a cable company sells a bundle of Internet, phone, and television for a single price, no service separately)
  - Mixed bundling: goods are available as a package or separately.

Pure Bundling

- Corel Wordperfect Office is a pure bundle. Their components are not sold individually but only as part of the bundle.
- Whether it pays for Corel to sell a bundle or sell the programs separately depends on how reservation prices for the components vary across customers.
- Bundling increases profits if reservation prices are negatively correlated and it reduces profits it they are positively correlated.
- We assume the marginal cost of producing an extra copy of either type of software is essentially zero; fixed cost is negligible so that the firm's revenue equals its profit; the firm must charge all customers the same price-it cannot price discriminate.

Profitable Pure Bundling

	Word Processor	Spreadsheet	Bundle
Alisha	\$120	\$50	\$170
Bob	\$90	\$70	\$160
Profit-maximizing price	\$90	\$50	\$160
Units sold	2	2	2

- The reservation prices are negatively correlated: the customer who has the higher reservation price for one product has the lower reservation price for the other product.
- If the firm sells the two products separately, it maximizes its profit by charging \$90 for the word processor and selling it to both consumers, and selling the spreadsheet program for \$50 to both consumers. The firm's total profit from selling the programs separately is \$280 $(= \$180 + \$100)$.
- If the firm sells the two products in a bundle, it maximizes its profit by charging \$ 160, selling to both customers, and earning \$320. Pure bundling is more profitable.

Unprofitable Pure Bundling

	Word Processor	Spreadsheet	Bundle
Carol	\$100	\$90	\$190
Dmitri	\$90	\$40	\$130
Profit-maximizing price	\$90	\$90	\$130
Units sold	2	1	2

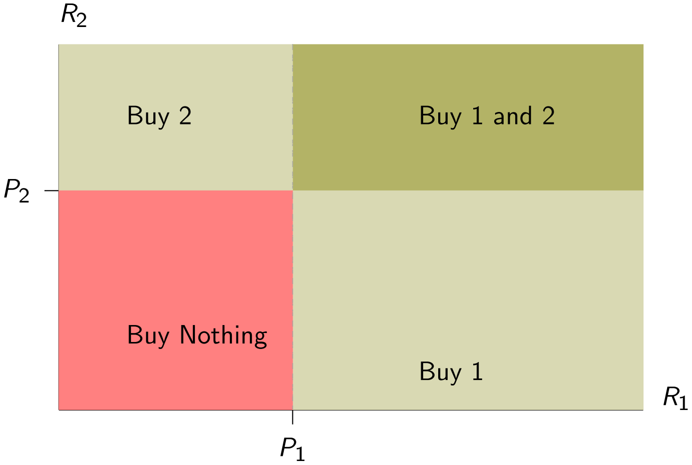
- The reservation prices are positively correlated: a higher reservation price for one product is associated with a higher reservation price for the other product.
- If the programs are sold separately, the firm charges \$90 for the word processor, sells to both consumers, and earns \$180. However, it makes more charging \$90 for the spreadsheet program and selling it only to Carol. The firm's total profit if it prices separately is \$270 (= \$180 + \$90).
- If the firm uses pure bundling, it maximizes its profit by charging \$130 for the bundle, selling to both customers, and making \$260.
- Firm earns more selling the programs separately than when it bundles

Mixed Bundling

	Word Processor	Spreadsheet	Bundle
Aaron	$120	$30	$150
Brigitte	$110	$90	$200
Charles	$90	$110	$200
Dorothy	$30	$120	$150

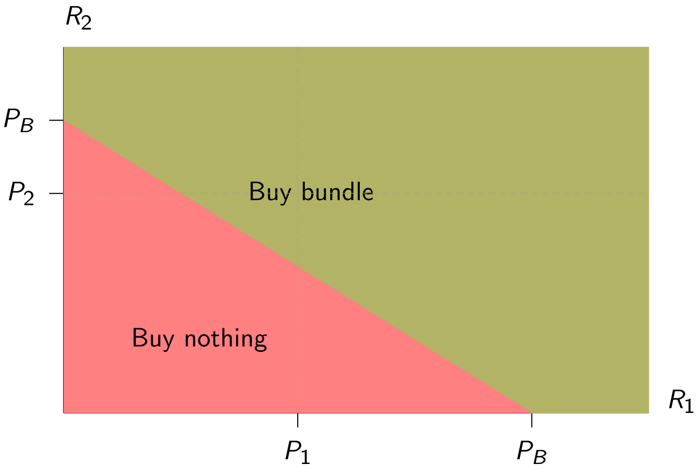
- Aaron, a writer, places high value on the word processing program but has relatively little use for a spreadsheet. Dorothy, an accountant, has the opposite pattern of preferences. Brigitte and Charles have intermediate reservation prices that are negatively correlated.
- If the firm prices each program separately, it maximizes its profit by charging $90 for each product and selling each to three customers. It earns $540 total.
- If the firm engage in pure bundling, it can charge $150 for the bundle, sell to all four consumers, and earns $600 total.
- If the firm does mixed bundling, it can charge $200 for the bundle to two consumers and $120 for each product separately to the other two consumers. It earns $640 total.

Price Separately



- Buy good 1 if $P_1 < R_1$ where R_1 is reservation price(or value) for good 1.
- Buy good 2 if $P_2 < R_2$ where R_2 is reservation price(or value) for good 2.

Pure Bundling



- Buy bundle if $P_B < R_1 + R_2$ and $P_B < P_1 + P_2$.
- Lower P_B implies more sales but less revenue from each sale.

Mixed Bundling

Consumers' choice depends on their available options and reservation value.

1. $P_1 < R_1$ and $P_2 < R_2 \rightarrow$ Reservation option is buying both goods individually.

$$CS_B = R_1 + R_2 - P_B > R_1 - P_1 + R_2 - P_2 = CS_1 + CS_2$$

   Buy bundle.

2. $P_1 < R_1$ and $P_2 > R_2 \rightarrow$ Reservation option is buying only good 1. Buy bundle if and only if

$$\begin{aligned} CS_B = R_1 + R_2 - P_B &> CS_1 = R_1 - P_1 \\ R_2 &> P_B - P_1 \end{aligned}$$

   and buy only good 1 otherwise.

Mixed Bundling

1. $P_1 > R_1$ and $P_2 < R_2 \rightarrow$ Reservation option is buying only good 2. Buy bundle if and only if

$$\begin{aligned} CS_B = R_1 + R_2 - P_B &> CS_2 = R_2 - P_2 \\ R_1 &> P_B - P_2 \end{aligned}$$

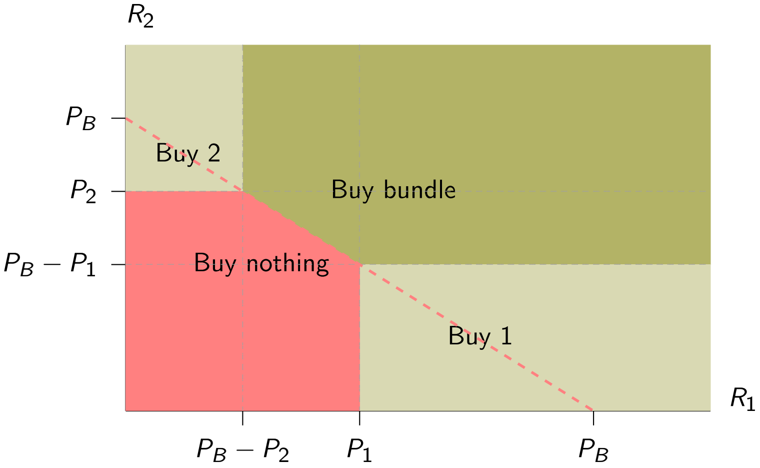
and buy only good 2 otherwise.

2. $P_1 < R_1$ and $P_2 < R_2 \rightarrow$ Reservation option is buying nothing. Buy bundle if and only if

$$CS_B = R_1 + R_2 - P_B > 0$$

and buy nothing otherwise.

Mixed Bundling



Requirement tie-in-sales

- Another form of bundling requiring customers who buy one product from a firm to make all concurrent and subsequent purchases of a related product from that firm.
- Allows the firm to identify heavier users and charge them more per unit.
- Examples include:
  - If a printer manufacturer can require that consumers buy their ink cartridges only from the manufacturer, then that firm can capture most of the consumer' surplus.
  - Heavy users of the printer, who presumably have a less elastic demand for it, pay the firm more than light users because of the high cost of the ink cartridges.
  - Printer firms such as Hewlett-Packard (HP) write their warranties to strongly encourage consumers to use only their cartridges and not to refill them.

Cost-Plus Pricing

In practice, managers often employ cost-plus pricing,

- Cost-plus pricing: price is set by first calculating the variable cost, adding an allocation for fixed costs, and then adding a profit percentage or markup.

- Prices include a "mark-up" above the production costs.

- The percentage mark-up for this strategy can be expressed as:

$$\text{Mark-up} = \frac{\text{Price - Average Cost}}{\text{Average Cost}}$$

  where Price - Cost is profit margin.

- Or equivalently:

$$\text{Price} = \text{Average Costs}(1+\text{Mark-up})$$

Cost-Plus Pricing

Recall that profit maximizing requires

$$\begin{aligned} MR(q) &= MC(q) \\ P(q)\left(1 - \frac{1}{|E_D|}\right) &= MC(q) \\ P(q) &= MC(q)\frac{|E_D|}{|E_D| - 1} \end{aligned}$$

- A manager can maximize profits by choosing MC instead of AC and a mark-up such that

$$\text{Mark-up} = \frac{1}{|E_D| - 1}$$

- Mark-up reduces as demand becomes more elastic.

Problems with cost-plus pricing

- Calculation of Average Variable Cost
- Allocation of Fixed cost
- Size of the markup

Other Pricing Practices

- Price skimming
  - the first firm to introduce a product may have a temporary monopoly and may be able to charge high prices and obtain high profits until competition enters
- Penetration pricing
  - selling at a low price in order to obtain market share
- Limit pricing
  - A monopolist will set price below $\text{MR} = \text{MC}$ to prevent potential customers from entering the market.

Other Pricing Practices

- Predatory pricing
  - Setting price below marginal cost to drive competitors out of the market
- Prestige pricing
  - demand for a product may be higher at a higher price because of the prestige that ownership bestows on the owner
- Psychological pricing
  - demand for a product may be quite inelastic over a certain range but will become rather elastic at one specific higher or lower price

What causes a Monopoly?

- The main cause of monopolies is barriers to entry : other firms cannot enter the market.
- Three sources of barriers to entry:
  1. Natural Barriers $\Rightarrow$ Natural Monopoly
     - When firm's minimum efficient scale is very high
  2. Ownership Barriers
     - E.g., DeBeers owns many of the world's diamond mines, OPEC holds a bulk of world oil reserves.
  3. Legal Barriers $\Rightarrow$ Legal Monopoly
     - The govt gives a single firm the exclusive right to produce the good.
     - E.g., Public franchise, Government license, Patents, Copyrights
- Also, the good that is supplied has no close substitutes.