Chapter 6 Bundling, Tying, and Dealership

- Bundling and Typing
- Tying as product differentiation
- Dealership distributing at a single location
- Resale price maintenance and advertising
- Territorial dealerships

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Bundling and Tying

- Bundling: refer to a marketing method in which firms offer for sale packages containing more than one unit of the product
  - Nonlinear pricing
  - Quantity discount (e.g. buy one unit , and get one free)
  - Volume discounts on phone calls
  - Frequent-flyer mileage earned by passengers who convert them to free tickets

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Bundling and Tying

- Tying: refer to firms that offer for sale packages containing at least two different products
  - A car dealer may offer cars with an already installed car radio
  - A computer dealer may include some software packages with the sale of computer hardware
  - A book store may provide a T-shirt to a customer who purchases a book

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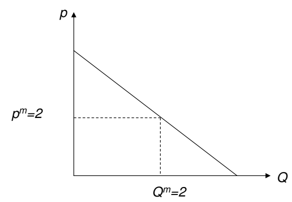
Bundling

- Consider a monopoly selling a product to a single consumer whose demand curve is given by $Q(p)=4-p$



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Bundling

- Without bundling
  - The monopoly will set $p^m=2$ and sell $Q^m=2$
  - $\pi^m=2*2=4$
- With bundling
  - Bundles four units of the product in a single package and offers it for sale for $8 (minus 1 cent)
  - $\pi^m=(4*4)/2=8$

Implication: A bundling monopolist earns the same profit as a perfectly discriminating monopoly

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Tying

- Consumers are heterogeneous in the sense that they have different valuations for different product
- Firms can increase their profits by selling the different product in one package

	Product *X*	*Y*
Customer 1	*H*	*L*
Customer 2	*L*	*H*

$H>L>0$

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Tying

- No typing

$$p_X^{NT} = p_Y^{NT} = \begin{cases} H & \text{if } H > 2L \\ L & \text{if } H < 2L \end{cases} \qquad \pi_X^{NT} = \begin{cases} 2H & \text{if } H > 2L \\ 4L & \text{if } H < 2L \end{cases}$$

- Typing

$$p^T = H + L \qquad \pi^T = 2(H+L)$$

$$\Rightarrow \quad \pi^T > \pi_X^{NT}$$

Tying and foreclosure

- Why does antitrust law assume that bundling and typing may reduce competition ?
- Two consumers (type 1 and type 2) and two-system
- Suppose that consumers desire to purchase a system that combines one unit of a computer hardware and one monitor
- There are two firms producing computers *X*, *Y*, and one monitor company which we denote by *Z*. We assume that monitor are compatible with both brands X and Y
- Consumers preferences are given by

$$U^1 \equiv \begin{cases} 3 - p_X - p_Z & \text{buys } X \text{ and } Z \\ 1 - p_Y - p_Z & \text{buys } Y \text{ and } Z \\ 0 & \text{Otherwise} \end{cases} \qquad U^2 \equiv \begin{cases} 1 - p_X - p_Z & \text{buys } X \text{ and } Z \\ 3 - p_Y - p_Z & \text{buys } Y \text{ and } Z \\ 0 & \text{Otherwise} \end{cases}$$

Tying and foreclosure (Cont')

- Three independent firms
  - $p_X=p_Y=2, p_Z=1$ constitute a Nash-Bertrand equilibrium ($\pi_X=\pi_Y=\pi_Z=2$)
  - Equilibrium is not equilibrium
  - $(p_X, p_Y, p_Z)=(1,1,2)$, $(0,0,3)$, and $(3,3,0)$ are also Nash equilibria
- Firm *X* takes over firm *Z*
  - By setting the package price to $p_{XZ}=3$, the firm selling the package *XZ* derives firm *Y* out of business
  - Foreclosing is not profitable for the typing firm ($\pi_{XZ}=0$)
  - Type 2 customer is not served

  (if firm *Y* sets $p_Y=0$, $U_2=3-p_{XZ}-p_Y=0$)

Tying and foreclosure (Cont')

- Let $\varepsilon>0$ be a small number
  - $p_{XZ}=3-\varepsilon$, $p_Y=\varepsilon$ constitutes an ε -foreclosure equilibrium
  - An ε -foreclosure equilibrium yields a higher profit level to fore-closing firm than does the total foreclosure equilibrium ($\pi_{XZ}=2(3-\varepsilon)$)

Tying as product differentiation

- Customers attach the same value *B* to the basic product
- Service attach value *s* to customer type *s*
- Individual utility function is given by

$$U^S = \begin{cases} B - p^N & \text{if bought without services} \\ B + s - p^S & \text{if bought tied with service} \end{cases}$$

- Let *m*>0 denote the unit production cost of the basic product, and let *w*>0 denote the production cost of service

Tying as product differentiation (cont')

$\hat{s}$ is the market size and share of non-serviced product:

$$B + \hat{s} - p^S = B - p^N$$

$$\Rightarrow \quad \hat{s} = \begin{cases} 1 & \text{if } p^S - p^N \geq 1 \\ p^S - p^N & \text{if } 0 < p^S - p^N \leq 1 \\ 0 & \text{if } p^S \leq p^N \end{cases}$$

Let *m* denote the production cost of services , and let *w* denote the production of cost of services

Profit of firm who provides tied services : $\pi^S = (p^S - m - w)(1 - \hat{s})$

Profit of firm who provides untied services : $\pi^N = (p^N - m)\hat{s}$

Tying as product differentiation (cont')

FOC

$$\frac{\partial \pi^S}{\partial p^S} = 1 - 2p^S + p^N + m + w = 0 \qquad \frac{\partial \pi^N}{\partial p^N} = p^S - 2p^N + m = 0$$

$$\Rightarrow \quad p^S = \begin{cases} p^N & \text{if } p^N \geq m+w+1 \\ \frac{1}{2}(1+m+w+p^N) & \text{if } m+w-1 < p^N \leq m+w+1 \\ [p^N+1, \infty) & \text{if } p^N < m+w-1 \end{cases} \quad p^N = \begin{cases} p^S - 1 & \text{if } p^N \geq m+2 \\ \frac{1}{2}(m+p^S) & \text{if } m < p^S \leq m+2 \\ [p^S, \infty) & \text{if } p^S < m \end{cases}$$

$$\Rightarrow \quad p^S = \frac{2}{3}(1+w)+m; 1-\bar{s} = \frac{1}{3}(2-w); \pi = \frac{1}{9}(2-w)^2$$
$$p^N = \frac{1}{3}(1+w)+m; \bar{s} = \frac{1}{3}(1+w); \pi = \frac{1}{9}(1+w)^2$$

Implication: increase the price of the untied good and the price of the tied product $\partial p^S / \partial w > 0, \partial p^N / \partial w > 0$

Tying as product differentiation (cont')

- Socially optimal provision of service
- Achieved by marginal-cost pricing
  - $p^S=m+w$ and $p^N=m$
- Demand of non-serviced product
  - $s^*=p^S - p^N = w$

$$\bar{s} < s^* \text{ if and only if } w > \frac{1}{2}$$

Implication:
if wage rate of the service is high ($w>1/2$), than the number of product tied with service exceed socially optimal level ($s<s^*$)
Implication:
if wage rate of the service is low ($w<1/2$), than the number of product tied with service is lower than socially optimal level ($s>s^*$)

Tying as product differentiation (cont')

- Counterintuitive
  - under a high wage rate one would expect the sales of the service-typing firm to over-taken by the (discount) firm that sells with no service
- Explanation
  - No servicing firm takes an advantage of the servicing firm's high service-production cost and raises its price thereby losing market share to the high-cost servicing firm
  - When $w>1/2$, the firm that sells without service charges a higher markup

$$\frac{\bar{p}^S-(m+w)}{m+w} = \frac{2-w}{3(m+w)} < \frac{1+w}{3m} = \frac{\bar{p}^N-m}{m}$$

Markets for Used Textbooks

- Suppose that in each period t, t=1,2, there are n student
- The students graduate at the end of period 1 and offer for sale to the n period 2 newly entering student
- The value of new and used book to an entering student is V
- Denote by pt the period t price of a book, i=1,2. The utility of a "generation t" student is given by

$$U_t = \begin{cases} V - p_t & \text{if the student buys a book} \\ 0 & \text{if the student does not buy the book} \end{cases}$$

Markets for Used Textbooks (cont')

- Assume there is only one textbook publisher
- In the period 1 the publisher sells a brand-new textbook
- The unit production cost of a book is c
- In the second period, the monopoly can invest an amount of F to revise the textbook

Markets for Used Textbooks (cont')

- Second period actions action taken by the textbook publisher
  - (1)Introduction of a new edition
    - All the n period 2 students purchase new books
    - the monopoly price $p^N_2 = V$, $\pi^N_2=n(V-c)-F$
  - (2)Selling the old edition
    - The publisher and n period 1 students compete in homogeneous product
    - $p^U_2 = c$, $\pi^U_2=0$
  - (3) the publisher introduce a new edition if $F<n(V-c)$

Markets for Used Textbooks (cont')

Profit of the publisher

$$\pi = \begin{cases} n(V-c)+n(V-c)-F & \text{if } F < n(V-c) \\ n(V+c-c) & \text{if } F > n(V-c) \end{cases}$$

Surplus of consumers

	generation 1 (U_1)	generation 2 (U_2)
New Revision	0	0
No Revision	$n[V-(V+c)+c]=0$	$n(V-c)$

Markets for Used Textbooks (cont')

Welfare in textbook market

$$W = U_1 + U_2 + \pi = \begin{cases} n(V-c)+n(V-c)-F & \text{new edition} \\ nV + n(V-c) & \text{no revision} \end{cases}$$

⇨ Implication: A new edition is socially undesirable

Dealership

- The common arrangements between manufactures and distributors are
  - (1) exclusive territorial arrangement: a dealer is arranged a territory of consumers from which other dealers selling the manufacturer's product are excluded
  - (2) exclusive dealership: prohibits the dealer from selling competing brands
  - (3) full-line forcing: the dealer is committed to sell all varieties of the manufacturer's products rather than a limited selection
  - (4) resale price maintenance: the dealer agrees to sell in a certain price range (minimum or maximum price required by the manufacturer

Dealership distributing at a single location (cont')

- Consider a market for a homogeneous product. The demand for the product is linear and given by $p=a-Q$
- Assume a manufacturer who sells a homogeneous product (each unit d dollar) to a single distributor who is the sole sellers of the product.
- The dealer chooses the number of units given by

$$\max_Q \pi^d = P(Q)Q - dQ = (a-Q)Q - dQ$$

$$\frac{\partial \pi^d}{\partial Q} = a - 2Q - d = 0 \Rightarrow Q^d = \frac{a-d}{2}, p^d = \frac{a+d}{2}\pi^d, \text{ and } \pi^d = \frac{(a-d)^2}{4}$$

Dealership distributing at a single location (cont')

- With a unit production cost of c, the manufacturer's profit maximization problem is

$$\max_Q \pi^d = (d-c)Q^d = (d-c)\left(\frac{a-d}{2}\right)$$

$$\frac{\partial \pi^M}{\partial d} = a - 2d + c = 0 \Rightarrow d = \frac{a+c}{2}$$

$$\Rightarrow Q^d = \frac{a-c}{4}, p^d = \frac{3a+c}{4}\pi^d, \pi^d = \frac{(a-c)^2}{16} < \pi^M = \frac{(a-c)^2}{8}$$

Implication: The manufacturer earns a higher profit than the dealer

Dealership distributing at a single location (cont')

- If the manufacturer produces and sells its product earns a profit

$$\Rightarrow \pi^{MD} = \frac{(a-c)^2}{4} > \frac{(a-c)^2}{8} + \frac{(a-c)^2}{16} = \pi^M + \pi^D$$

Implication: The total industry profit is lower than the profit earned by a single manufacturer/seller monopoly firm

Dealership distributing at a single location (cont')

- Two-part tariff contracts
  - The manufacturer sells each unit of output to the dealer for $d=c$, but in which the dealer has to pay, in addition, a lump-sum participation fee (denoted by Φ)
  - A two-part tariff contract with

$$d = c, \text{ and } \phi = \frac{(a-c)^2}{4}$$

yields the pure monopoly profit to the manufacturer and no loss to the dealer

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Resale price maintenance and advertising

- The purpose of resale price maintenance
  - It can (partially) solve the low industry profit associated with the manufacturer and dealer's double markup
  - It can induce the dealers to allocate resource for promoting the product
- Assume the demand for the product is given by

$$p = \sqrt{A} - Q$$

- Denote by d the per unit price at which the manufacturer sells to dealers. A_i the expenditure on advertising by dealer i, i=1,2. The aggregate advertising spending level is given by $A=A_1+A_2$

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Resale price maintenance and advertising (cont')

- Without resale price maintenance, for any given d, no dealer would engage in advertising and the demand would shrink to zero, so no sales are made ($p_i=d$, $\pi_i=0$)
- Resale price maintenance can eliminate price competition among dealers and induce them to engage in advertising
  - The manufacturer mandates a price floor to both dealers that we denoted by p^f (where $p^f > d$)
  - Each dealer i choose advertising level A_i, which is given by $\max_{A_i} \pi_i^D = \frac{\sqrt{A_i + A_j} - p^f}{2}(p^f - d) - A_i$

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Resale price maintenance and advertising (cont')

- Each dealer i choose advertising level A_i, which is given by

$$\max_{A_i} \pi_i^D = \frac{\sqrt{A_i + A_j} - p^f}{2}(p^f - d) - A_i$$

$$\Rightarrow \frac{\partial \pi_i^D}{\partial A_i} = \frac{p^f - d}{4\sqrt{A_i + A_j}} - 1 = 0$$

$$A_i + A_j = \left(\frac{p^f - d}{4}\right)^2$$

Implication: the aggregate dealers spending on advertising increases with an increase in the gap between the price floor and the dealer's per unit fee (p^f-d)

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Territorial dealerships

- Assume the manufacturer's production cost is zero (c=0)
- The manufacturer sells each unit of the product to each dealer for a price of d to be determined by the manufacturer
- Each dealer has to invest an amount of F>0 in order to establish a dealership
- Consider a city with two consumers located at the edges of town. The transportation cost from an edge of town to the center is measured by T
- Let B denote the basic value each consumer attaches to the product

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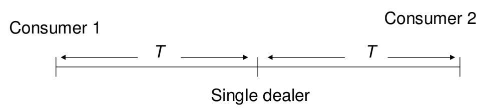
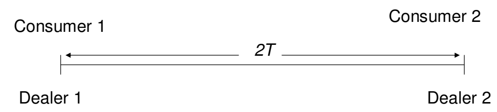
Territorial dealerships (cont')





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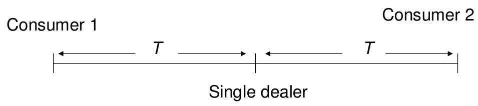
Exclusive territorial dealership located at the town center

- The dealer
  - The dealer charges the customer $p^D=B-T$
  - with profit $\pi^D=2(B-T-d)-F$
- The manufacturer
  - The dealer charges the dealer $d=B-T-F/2$
  - With profit $\pi^M=2(B-T)-F$



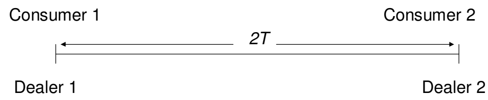
Two dealerships

- Conditions for two dealerships with competition
$$\pi_1^D = p_1^D - d - F \geq 2(p_2^D - 2T - d) - F$$
$$\pi_2^D = p_2^D - d - F \geq 2(p_1^D - 2T - d) - F$$

The dealer sets price $p^D = B$

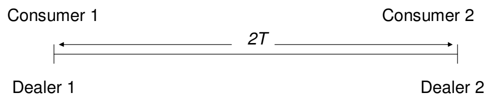
The manufacturer sets price $d = B - F$

$$B-(B-F)-F \geq 2(B-2T-(B-F))-F \Rightarrow F < 4T$$



Two dealerships (cont')

- The manufacturer
  - The dealer charges the dealer $d=B-F$
  - With profit $\pi^M=2(B-F)$



Two dealerships (cont')

- Compare π^M(single dealer) $=2(B-T)-F$ and π^M(two dealers) $=2(B-F)$
- If the city is large ($F<4T$), then the manufacturer will grant a single dealership to be located at the center if $2T<F<4T$, and two dealerships to be located at the edges of town if $F<2T$
- If the city is small ($F>4T$), then the manufacturer will grant a single dealership to be located at the center

Two dealerships (cont')

- Solution for two dealerships in a small city ($F>4T$)
  - (1) imposed territorial–exclusive dealerships
    - The manufacturer limits the territory of dealer 1 to selling only on [0,1/2) and of dealer 2 to selling on [1/2,1]
    - Each dealer becomes a local monopoly and charge $p_i^D=B$
  - (2) use resale-price-maintenance mechanism (RPM)
    - The manufacturer mandates the dealer to set $p_i^D=B$