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EE481

Price Discrimination

27.10.2016

Case Study (Grabowski and Vernon, 1992)

Question: Does competition always lower price?

- New drugs get patents to grant their monopoly rights.
- But after the patent expires, anyone else can use the formula to produce their drugs (generic brands).
- Grabowski and Vernon (1992) found that after the patent (of 18 major drugs) expires, sale dropped by 50% but price increased 10%.
  - Apparently, there are 2 types of consumers - the loyal and the price-sensitive.
  - The loyals do not switch to generics and are willing to pay more.
  - The patented firm then focus only on the loyal customers -> and charge a higher price.

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Price Discrimination

Up to now, consider situations where each firm sets one uniform price.

- Consider cases where firm engages in non-uniform pricing:
  1 Charging customers different prices for the same product (airline tickets)
  2 Charging customers a price depending on the quantity purchased (electricity, telephone service)
- Consider three types of price discrimination:
- **Perfect price discrimination:** charging each consumer a different price. Often infeasible.
- **Third-degree price discrimination:** charging different prices to different groups of customers
- **Second-degree price discrimination:** each customer pays her own price, depending on characteristics of purchase.
- Throughout, consider just monopoly firm.

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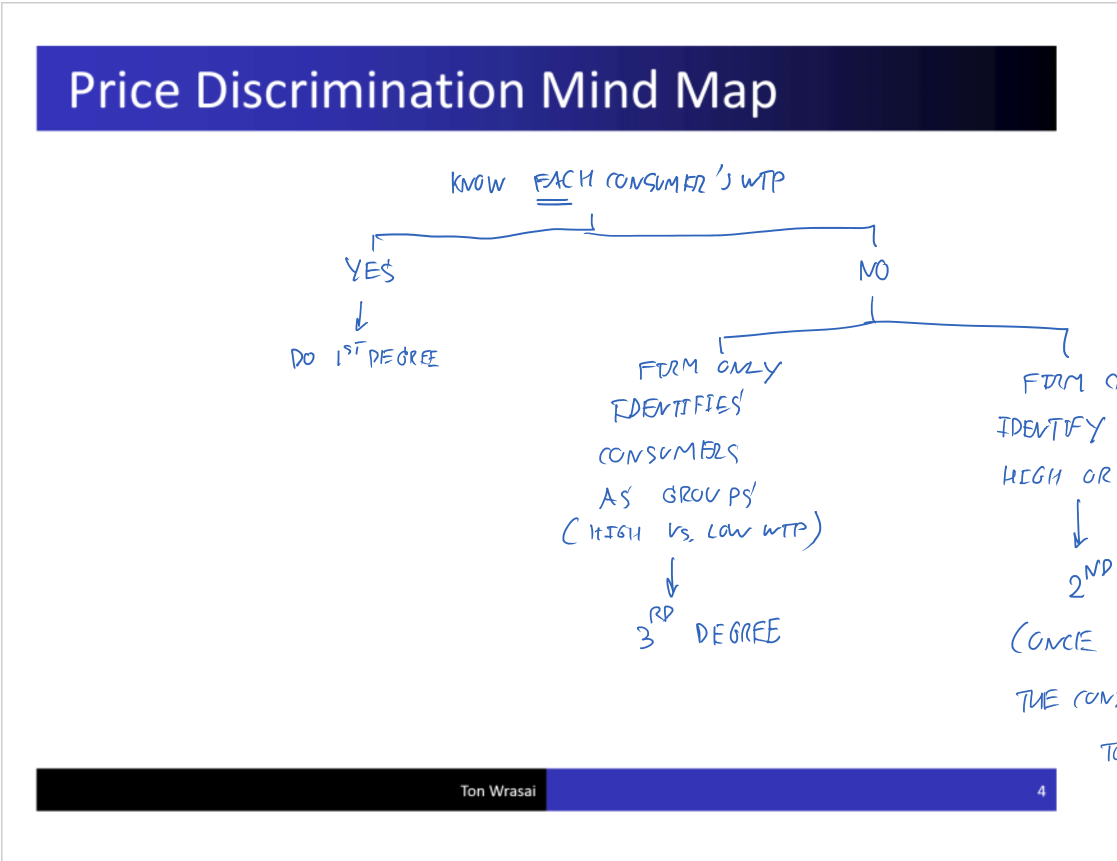

KNOW EACH CONSUMER'S WTP

YES

DO 1ST DEGREE

NO

FIRM ONLY IDENTIFIES CONSUMERS AS GROUPS (HIGH VS. LOW WTP)

3RD DEGREE

FIRM CANNOT IDENTIFY WHO HAS HIGH OR WHO HAS LOW WTP

2ND DEGREE

(ONCE CONSUMERS DO SELF-SELECTION, THE CONSUMERS REVEAL THEIR TYPE TO THE FIRM)

SELF-SELECTION AS A SIGNALLING TO TYPES.

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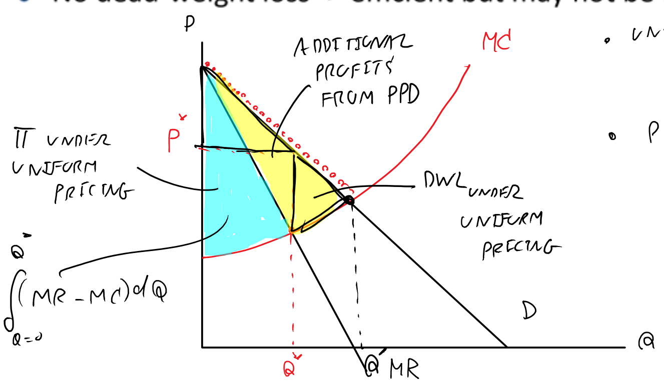
Perfect Price Discrimination (PPD)

- Firm can identify the willingness to pay of every consumer.
- Perfectlly discriminating monopolist makes much higher profits (takes away all of the consumer surplus)
- No dead-weight loss -> efficient but may not be fair.

EX: DOCTOR FEES

- INFORMATION → WTP
- ARBITRAGE → RESALES ARE IMPOSSIBLE



- UNIFORM PRICING: $P = P^*$, $Q = Q^*$

- PPD: $Q = Q'$

- MONOPOLIST CAPTURES ALL CONSUMER SURPLUSES
- NO DWL! (THAT'S EFFICIENT!)

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Third-Degree Price Discrimination (3PD)

- Monopolist only knows demand functions for dierent groups of consumers (graph): groups differ in their price responsiveness.
- Cannot distinguish between consumers in each group (ie., resale possible within groups, not across groups)
  - Student vs. Adult tickets
  - Journal subscriptions: personal vs. institutional
  - Gasoline prices: urgent vs. non-urgent
- Main ideas: under optimal 3PD|
- Charge different price to different group, according to inverse-elasticity rule. Group with more elastic demand gets lower price.
- Can increase consumer welfare: group with more elastic demand gets lower price under 3PD.

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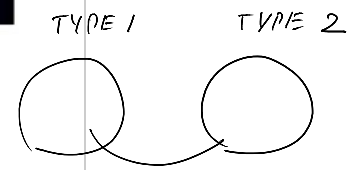

RESALES ACROSS THE GROUPS MUST BE IMPOSSIBLE

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Third-Degree Price Discrimination (maths)

- In general, price-discriminating monopolist follows inverse elasticity rule with respect to each group:

SUPPOSE WE HAVE TWO GROUPS: GROUP A VS. GROUP B

$$\frac{(p_i - MC(q_i))}{p_i} = -\frac{1}{\epsilon_i} \rightarrow \frac{P - MC_i}{P} = -\frac{1}{\varepsilon} = \frac{1}{|\varepsilon|}$$

$$P - MC_i = \frac{P}{|\varepsilon|} \rightarrow P - \frac{P}{|\varepsilon|} = MC_i \rightarrow P\left(1 - \frac{1}{|\varepsilon|}\right) = MC_i \rightarrow \boxed{P = \frac{MC_i}{\left(1 - \frac{1}{|\varepsilon|}\right)}}$$

$$P_A = \frac{MC_i}{1 - \frac{1}{|\varepsilon|_A}} \qquad P_B = \frac{MC_i}{1 - \frac{1}{|\varepsilon|_B}}$$

WHEN $|\varepsilon|_B > |\varepsilon|_A$, $P_A > P_B$. #

- or (assuming constant marginal costs)

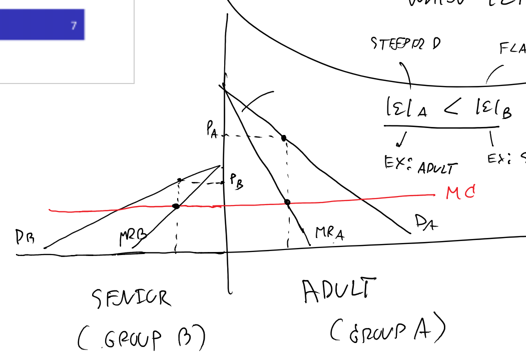
$$\frac{p_i}{p_j} = \frac{1 + \frac{1}{\epsilon_j}}{1 + \frac{1}{\epsilon_i}}$$

WE CHARGE A HIGHER PRICE TO CONSUMERS W/ LOW PRICE ELASTICITY AND LOWER PRICE TO CONSUMERS W/ HIGH PRICE ELASTICITY.

STEEPER D — FLATTER D

$\underbrace{|\varepsilon|_A < |\varepsilon|_B}$: PRICE ELASTICITY OF DEMAND FOR GROUP A IS LOWER THAN GROUP B.

EX: ADULT — EX: SENIOR



Third-Degree Price Discrimination (maths)

- This is the “Ramsey pricing rule”: (roughly speaking) consumers with less-elastic demands should be charged higher price
  - Senior discounts
  - Food at airports, ballparks, concerts
  - Optimal taxation
- Caveat: this condition is satisfies only at optimal prices (and elasticity is usually a function of price)

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Second-Degree Price Discrimination (2PD)

- Price discrimination can be categorized into 3 types according to the completeness of information
- 1^{st} degree - firm observes the willingness to pay of EACH buyer.
- 2^{nd} degree - firm does not observe the willingness to pay of EACH buyer. But knows that different buyers have different willingness to pay.
- 3^{rd} degree - firm observes the willingness to pay of EACH... GROUP of buyers.

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Second-Degree Price Discrimination (2PD)

- Some forms of second-degree price discrimination
  - Two-part tariff
    - SINGLE TWO-PART TARIFF → W/ ONE KIND OF CUSTOMERS
    - TWO TWO-PART TARIFF → W/ TWO KINDS OF CUSTOMERS.
  - Multi-part tariff
  - Menu of Price or Price schedule
  - Bundling, Tie-in sale

SELL AS A PACKAGE
- PURE BUNDLING (AS A PACKAGE ONLY)
- MIXED BUNDLING
  - A
  - B
  - A+B

Second-Degree Price Discrimination

- Second-degree price discrimination is a form of non-linear pricing.
- Nonlinear Pricing = consumer's price per unit is not a constant
- Second-degree price discrimination uses the nonlinear pricing method to extract welfare from consumers.

Examples of Two-Part Tariff

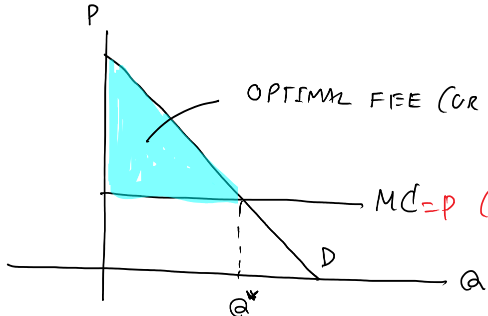
Firm changes a lump-sum fee AND a per-unit fee.

Product	Lump-sum	Per-unit fee
PRINTER	PRINTER	INK
PLAYSTATION	BOX	GAMES
FOOTBALL GAME	MEMBERSHIP FEE	TICKETS
NESPRESSO	COFFEE MACHINE	CAPSULES
DISNEYLAND	ENTRANCE FEE	EQUIPMENT SERVICES

A Single Two-Part Tariff

- Suppose there are 2 types of consumers
  - the High willingness to pay (high-type)
  - the Low willingness to pay (low-type)

OBJECTIVE: TO CAPTURE OR EXTRACT MORE OF CONSUMER SURPLUS.



OPTIMAL FEE (OR TARIFF)

MC=P (OPTIMAL PRICE LEVEL)

2-PART — FIXED, ONE-TIME FEE
— A PRICE PER EACH UNIT PURCHASED

THE RULE
(1) CHARGE THE ONE-TIME FEE = CONSUMER SURPLUS
(2) CHARGE PER UNIT PRICE = MARGINAL COSTS

Two Two Part Tariff

- Firms can increase their profits from offering two two-part tariff instead of a single two-part tariff
- different collateral-interest rate combinations
- different co-payment and insurance premium combinations
- offering buffet or a'-la-carte

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SUPPOSE WE HAVE N CONSUMERS, EACH W/ A DEMAND CURVE Q(P).

SO $\pi = \underbrace{N \cdot T}_{\text{ENTRANCE FEE}} + \underbrace{N(P \cdot Q)}_{\text{REVENUE}} - \underbrace{N(MC \cdot Q)}_{\text{COST}}$

AS THE MONOPOLIST CHARGES $P = MC$, THEN

$\pi = N \cdot T$.

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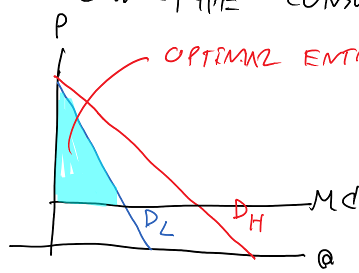
TWO KINDS OF CUSTOMERS

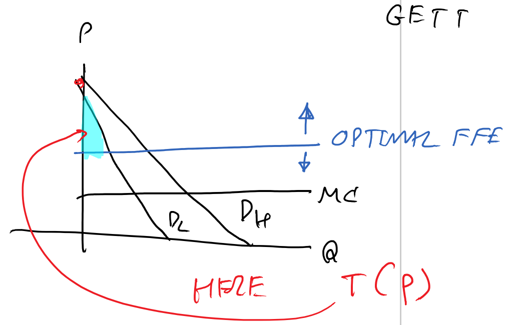
- HIGH-TYPE CONSUMERS,
- LOW-TYPE CONSUMERS.

(1)



OPTIMAL ENTRANCE FEE = AMOUNT OF CS OF LOW-TYPE CONSUMERS

(ATTRACT BOTH GROUPS TO GET T



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EXAMPLE

1) ONLY ONE TYPE OF CUSTOMERS – (DRINKERS OR PARTY ANIMALS)

$Q_{ANIMALS} = 10 - 2P$. (PRICE PER DRINK = P)

W/O TWO-PART TARIFF:

$P = 5 - \frac{Q}{2}$

$TR = \left(5 - \frac{Q}{2}\right) Q = 5Q - \frac{Q^2}{2}$

$MR = 5 - Q$

SET $MR = MC$ (LET'S SAY $MC = 0.5$ €/DRINK)

$5 - Q = 0.5$

$Q = 4.5$ DRINKS / PERSON

$P = 5 - \frac{Q}{2} = 5 - \frac{4.5}{2} = 2.75$ € / DRINK

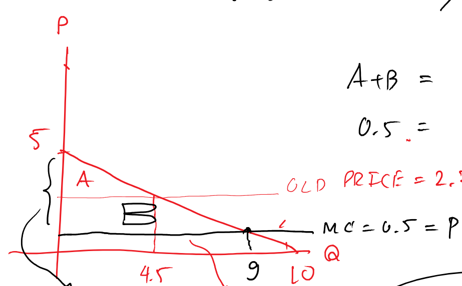
SUPPOSE $N = 500$, SO. $Q_{TOTAL} = 500 \cdot 4.5 = 2250$ DRINKS

$\pi = TR - TC = P \cdot Q - (1000 + 0.5Q)$

$= 2.75 \times 2250 - (1000 + 0.5 \cdot 2250)$

$= 4062.5$ € / NIGHT.

W/ TWO-PART TARIFF:



A+B = OPTIMAL FEE

0.5 = PER UNIT PRICE OF DRINK.

OPTIMAL FEE

$A + B = \frac{1}{2} \times (5 - 0.5) \times (9 - 0) = 20.25$ €

SO $\pi = TR - TC$

$= (500 \times \underset{(A+B)}{FEE} + \cancel{0.5Q}) - (1000 + \cancel{0.5Q})$

$= 500 \times FEE - 1000 = 20.25 \times 500 - 1000$

$= 9{,}125$ € / NIGHT.

BUNDLING

BUNDLING: A PRACTICE OF SELLING TWO OR MORE PRODUCTS AS A PACKAGE.

A FILM PRODUCER IS SELLING 2 MOVIES TO HIS CUSTOMERS (= THEATERS)

	DOCTOR STRANGE	FORREST GUMP
THEATER 1	12,000	3000
	∨	∧
THEATER 2	10,000	4000

(NUMBERS IN THE CELLS REPORT WTP BY EACH THEATER FOR EACH MOVIE)

OPTION 1: SELLING SEPARATELY

$P_{DOCTOR} = 10{,}000$

$P_{GUMP} = 3000$

TOTAL REVENUE = 10,000 (2) + 3000(2) = 26,000 € ——— (1)

OPTION 2: BUNDLING (SELL THE TWO MOVIES AS A PACKAGE)

$P_B = 14{,}000$ TO ATTRACT BOTH THEATERS.

SO, TOTAL REVENUE = 14,000 × 2 = 28,000 € ——— (2)

CONCLUSION: BUNDLING GIVES HIGHER TOTAL REVENUE THAN SELLING SEPARATELY (WHY?)

BUNDLING WORKS WHEN DEMANDS ARE NEGATIVELY CORRELATED:

RELATIVE VALUATIONS OF THE TWO FILMS ARE REVERSED

i.e., THE THEATER WILLING TO PAY THE MOST FOR DOCTOR STRANGE IS WILLING TO PAY THE LEAST FOR FORREST GUMP, VICE VERSA

CHECK IT OUT:

	DOCTOR STRANGE	GUMP
T1	12,000	4000
	∨	∨
T2	10,000	3000

OPTION 1: SELLING SEPARATELY $\begin{cases} P_D = 10{,}000 \\ P_G = 3000 \end{cases}$

TR = 10,000 · 2 + 3000 · 2 = 26,000 € ——— (3)

OPTION 2: BUNDLING → $P_B = 13{,}000$

TR = 13,000 × 2 = 26,000 € ——— (4)

AS DEMANDS ARE POSITIVELY CORRELATED, BUNDLING GIVES THE SAME OUTCOME AS SELLING SEPARATELY.

2-PART TARIFF w/ TWO KINDS OF CUSTOMERS

MT 35%

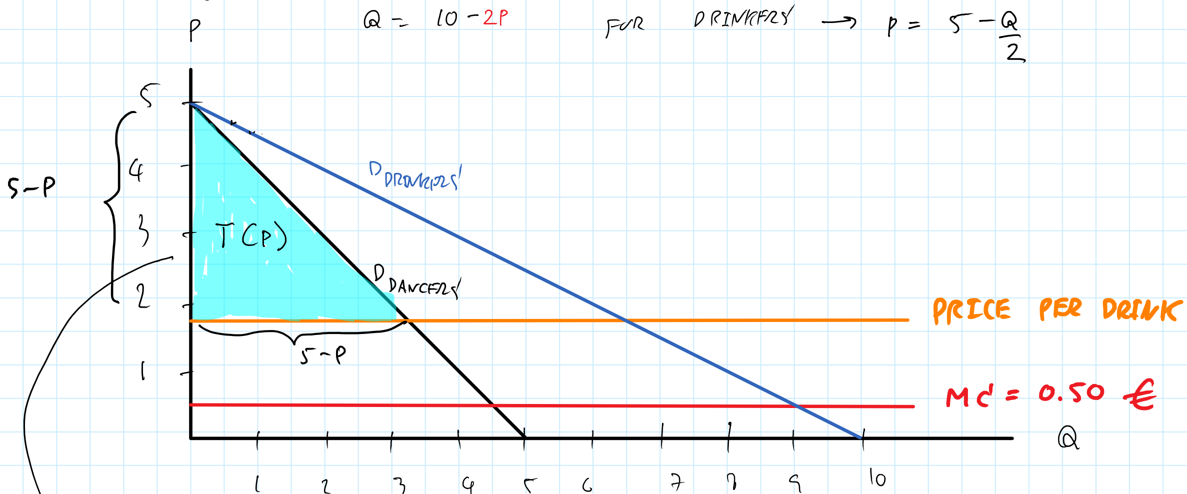
... ARE POSITIVELY CORRELATED, BUNDLING GIVES THE SAME OUTCOME AS SELLING SEPARATELY.

2-PART TARIFF w/ TWO KINDS OF CUSTOMERS

MT 35%
HW 15%
FN 50%

HOMEWORK: $Q = 5 - P$ FOR DANCERS
$Q = 10 - P$ FOR DRINKERS

HERE $Q = 5 - P$ FOR DANCERS $\rightarrow P = 5 - Q$
$Q = 10 - 2P$ FOR DRINKERS $\rightarrow P = 5 - \frac{Q}{2}$



THE COVER CHARGE IS A FUNCTION OF PRICE

COVER CHARGE $= T(P) = \frac{1}{2} \times (5-P) \times (5-P)$

$$= 12.5 - 5P + \frac{P^2}{2}$$

$$\pi = TR - TC = [\underbrace{1000 \times T(P)}_{\text{TR FROM COVER CHARGE}} + \underbrace{500 \times P \times (10-2P)}_{\text{TR FROM DRINKERS}} + \underbrace{500 \times P \times (5-P)}_{\text{TR FROM DANCERS}}]$$

$$- [\underbrace{1000}_{\text{FIXED COST}} + 0.5(500 \times (10-2P) + 500 \times (5-P))]$$

$$= 1000 \times \left(12.5 - 5P + \frac{P^2}{2}\right) + 5000P - 1000 \times P^2 + 2500P - 500P^2$$

$$- (1000 + 3750 - 750P)$$

$$\pi = -1000 \times P^2 + 3250P + 7750$$

TO FIND AN OPTIMAL PRICE (P^*), $\frac{\partial \pi}{\partial P} = 0$

$$P^* = 1.625 \text{ € / DRINK}$$

SUBSTITUTING P^* INTO THE COVER CHARGE FUNCTION GIVES

$$T(P^*) = 12.5 - 5(1.625) + \frac{(1.625)^2}{2}$$

$$= 5.70 \text{ € / PERSON}$$

$Q^* = 5 - P^* = 5 - 1.625 = 3.375$ DRINKS PER PERSON ...

$$= 5.70 \text{ €} / \text{PERSON}$$

$$Q^*_{DANCER} = 5 - P^* = 5 - 1.625 = 3.375 \text{ DRINKS PER PERSON PER NIGHT}$$

$$Q^*_{DRINKER} = 10 - 2P^* = 10 - 2(1.625) = 6.75 \text{ " ——— "}$$

$$\pi^* = -1000 \times (1.625)^2 + 3250(1.625) + 7750$$

$$\Rightarrow 10{,}391 \text{ € PER NIGHT}$$

TWO-PART TARIFFS : A SUMMARY

	COVER CHARGE	PRICE/DRINK	DRINKS/PERSON	π
• NO TWO-PART TARIFF	NONE	2.75	4.5	4,063 €
• ONE KIND OF CUSTOMERS	20.25	0.5	9.0	9,125 €
• TWO KINDS OF CUSTOMERS	5.70	1.625	6.75 (DRINKERS) 3.38 (DANCERS)	10,391 €

BY MAKING T(P) LOWER AND P HIGHER
π WILL BE HIGHER (i.e., get dancers to your bar!)

NOT NECESSARILY TO BE THE BEST STRATEGY, SOMETIMES, IT MAY BE MORE PROFITABLE TO FOCUS ONLY ON HIGH-YIELD CUSTOMERS.

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Reference and Further Reading

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