18. SCREENING BY SELF-SELECTION : PRICE DISCRIMINATION EXAMPLE

The seller is assumed to be a monopolist (at least, assume that rival sellers' strategies are fixed or passive; can be part of a game analysis, finding one firm's reaction function)

Firm does not know the demand function of any individual customer and so cannot present him with just the price intended to extract all of his consumer surplus (Perfect price discrimination is ruled out)

Suppose consumers can be grouped into types. The demand function by type is known. But firm does not know any individual's group identity (or is not legally allowed to use it)

Instead, the firm designs different purchase contracts in such a way that each group's members will self-select the one that was intended for them

Examples – restricted vs. unrestricted air fares, hardback vs. paperback books, ... (Quantity discount or block pricing schedules can also have this purpose)

Numerical example – Pie-In-The-Sky (PITS) airline's route between Podunk and Wobegon

100 potential customers each day; 70 tourist, 30 business

Each buys at most one ticket. Max willingness to pay for it is called "reservation price"

Type of ticket	PITS's cost	Reservation price		PITS's potential profit	
		Tourist	Business	Tourist	Business
Restricted	100	140	225	40	125
Unrestricted	150	175	300	25	150

Perfect price discrimination:

PITS can sell each Tourist (T) either a Restricted ticket for 140 (actually "just under")
or an Unrestricted ticket (U) for 175. Former gives it more profit
Similarly, sell each Business traveler (B) a U ticket at 300
Total profit = (140–100) * 70 + (300–150) * 30 = 40 * 70 + 150 * 30 = 2800 + 4500 = 7300

In this example, knowing and using information about group membership is
equivalent to perfect price discrimination (because complete homogeneity within group)
But suppose this is not known or not useable

Various strategies compatible with PITS's available or feasible information :

[1] R only - Either price at 140, profit 40 * 100 = 4000, or price at 225, profit = 125 * 30 = 3750

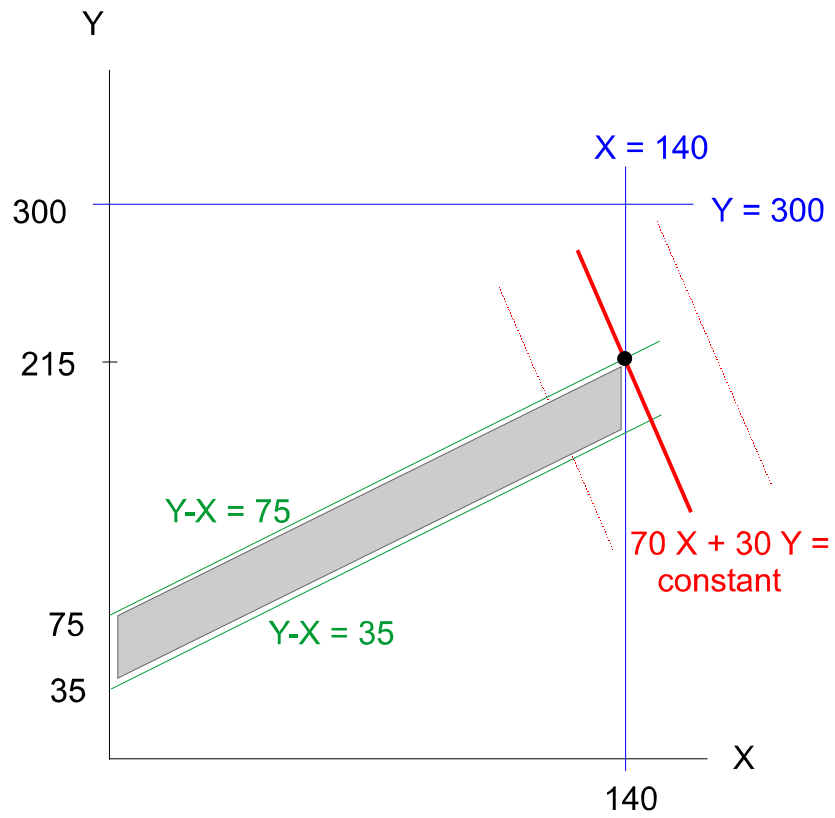
[2] U only - Either price at 175, profit 25 * 100 = 2500, or price at 300, profit = 150 * 30 = 4500

[3] Both, priced R at X, U at Y, to be determined
Each type of customer will buy the ticket that yields larger consumer surplus
Assume that each type B or T, when surpluses equal, will choose U
Want T to choose R : $140 - X > 175 - Y$, or $Y - X > 35$
Want B to choose U : $225 - X \leq 300 - Y$, or $Y - X \leq 75$

These give each type of consumer the right incentive to choose the type of ticket the airline wants him to choose –
Therefore they are called the
"incentive-compatibility" or
"self-selection" constraints
Figure shows them in green

The airline must also set
$X \leq 140$, else T doesn't buy R,
$Y \leq 300$, else B doesn't buy U
These are called
"individual rationality" or
"participation" constraints
Figure shows them in blue

So overall feasible region for choice of X, Y is the shaded area



PITS' profit is 70 (X - 100) + 30 (Y - 150) = 70 X + 30 Y - 11,500
Therefore PITS' iso-profit lines have equations 70 X + 30 Y = constant; they are shown in red

PITS' optimal choice is X = 140, Y = 215, shown by bullet
Resulting profit = (140–100) * 70 + (215–150) * 30 = 2800 + 1950 = 4750

This is better than that of any of the single type of service strategies in [1] and [2] (see below)
But less than the 7300 PITS could make if it could identify individuals' types
and use this information to implement perfect price discrimination

So the "screening by self-selection" strategy lets PITS
increase its profit above single-type strategies
by extracting some but not all consumer surplus
Each T-type still gets (almost) no surplus. But each B-type gets 300 – 215 = 85;
PITS can't charge them more than 215; they would buy R tickets, even worse for PITS.
This is PITS's cost of its information disadvantage (not knowing individuals' group identity)

What if there were 40 T types and 60 B types (instead of 70 T and 30 B)?
Perfect discrimination would yield profit 40 * 40 + 150 * 60 = 1600 + 9000 = 10600
PITS' profits from the various strategies would be

[1] R only - Either price at 140, profit 40 * 100 = 4000, or price at 225, profit = 125 * 60 = 7500
[2] U only - Either price at 175, profit 25 * 100 = 2500, or price at 300, profit = 150 * 60 = 9000
[3] Both, priced R at 140, U at 215; profit = 40 * 40 + 65 * 60 = 1600 + 3900 = 5550

Now U only at price 300 is best; optimal to not serve the smaller number of Tourists
in order to extract full surplus from the more numerous Business travelers!

More general theory later. Its basic conclusions:
[1] The "good" types must be allowed to keep some surplus for incentive compatibility
[2] Service to the "bad" types is distorted downwards to reduce this surplus loss