Exploitative Priority Services

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NTU mini-course on multi-agent contracts

“Priority boarding is a joke” ●○○○○

Review of Ryanair

James O
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Priority boarding is a joke

So the priority line is basically everyone. Do not bother with priority boarding. As far as Ryanair is concerned, it is just free money for no service since everyone else got it as well. At least with a mugging, I’d have got a story out of it

Date of travel: September 2019

Thank James O

Priority Services (PS)

- Priority Customers vs. Premium Customers
- Priority – lines/queues
- Medical Treatments
- Shipping (Amazon)
- Toll Roads
- Heathrow 12 pound priority security screening.
- Extortionate Priority Visa Fees (The Guardian)

Extortionate £800 ‘priority’ visa fee fails to deliver

With the Super Priority Service the implication is you'd receive a visa straight away – it took 38 days

Willingness to Pay for Priority

- n customers
- If k are ahead of you in line your waiting cost is kc.
- Every priority agent is served before any regular.
- Within each group - a random order.
- WTP if k agents purchased PS (Priority Service):
  - $kc + (1/2)(n-k)c = p + kc/2$
  - $cn/2 + kc/2 = p + kc/2$
  - $p = cn/2$ (is independent of k)

Gradually Generalizing

- Single firm and homogeneous customers
- Single firm and heterogeneous customers
- Competition with homogeneous customers
- Competition with heterogeneous customers
- Multiple levels of priority
- Endogenous pricing of the primary good
- Non-linear costs

Model 1: Single Service Provider

- Measure 1 of consumers seek service from a server.
  - Service time is 1.
  - Server can serve only single consumer at a time.
  - $q + p =$ Consumer Disutility paying price p for priority and having q consumers ahead of him/her in the line.
- Firm decides on price of priority; customers form an equil. simultaneously choosing P or R (priority/regular)
  - Priority customers are served before non-priority customers and within each group the service order is random.
- We assume that indifferent customers choose P.

Proposition 1:

- In the unique subgame-perfect equilibrium the firm charges the price $p = 1/2$ and all customers buy priority.
  - The firm provides no surplus with the priority service, yet extracts a revenue of $1/2$.
  - Customers are worse off with priority service than without it.
- Pr – the proportion of PS customers.
- $(1/2)Pr + p = Pr + (1/2)(1 - Pr) \Rightarrow p = 1/2$

Model 2: 1 Service Provider/Heterogeneous Customers

- Distribution of waiting costs is given by cdf F on support $[0,\ \hat{c}\ ]$ with $\hat{c} \geq 0$ and density f.
- The firm names a price p for the priority and customers choose priority service iff their willingness to pay for the service is at least p.
- Let $c(p)$ the type who's indifferent at price p.

$$-p - c(p)\frac{1-F(c(p))}{2} = -c(p)\left[(1-F(c(p)) + \frac{F(c(p))}{2}\right]$$

Priority

Regular

- $c(p) = 2p$

Comparing Consumers' Welfare

- Without Priority:

$$\int_0^{\hat{c}} \left[-\frac{c}{2} f(c)\right] dc = -\frac{E(c)}{2}$$

- With Priority

$$-\int_0^{c^*} c\left[1 - F(c^*) + \frac{F(c^*)}{2}\right] f(c)dc + \int_{c^*}^{\hat{c}} \left[-p(c^*) - c \cdot \frac{1 - F(c^*)}{2}\right] f(c)dc$$

Low types choose regular

High types choose priority

Proposition 3:

- If F satisfies Increasing Failure Rate, i.e.
- $\frac{1-F(c^*)}{f(c)}$ is decreasing

- Then, the total welfare of customers declines due to the option of priority service.

Example

- For the $\mathrm{uniform}[0,\,1]$ case, half of the consumers buy priority at $p = 1/4$. (because $c(p) = 2p$)
- the server's revenue is $1/8$.
  - Without priority service the cost of waiting is $E(c) = 1/4$
  - With PS it is $5/32$
- Efficiency gain $1/4 - 5/32 = 3/32$
- Hence, the monopolist extract the entire efficiency gain plus $1/32$.

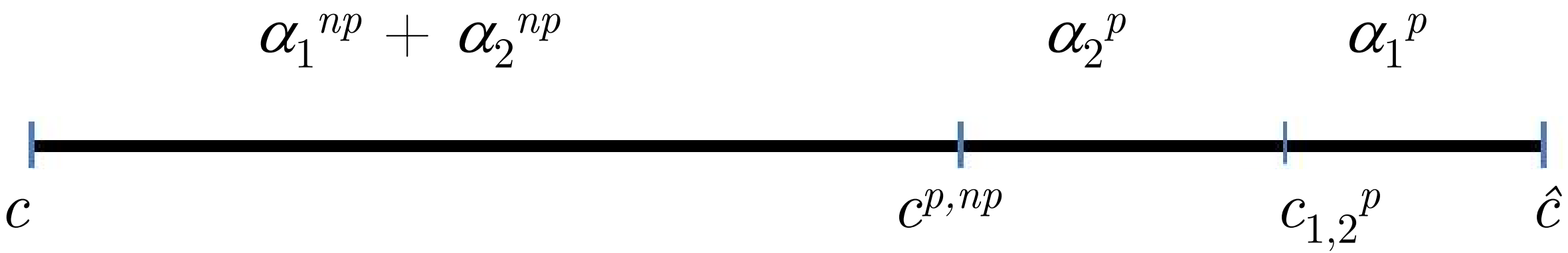
Model 3: Two Service Providers

- PS can have innate structural barriers to competition.
  - Stage 1: two providers simultaneously choose prices for their priority services: p_1 and p_2.
  - Stage 2: customers decide whether they go to firm 1 or firm 2 and whether they buy priority service or go for the regular one.
- $n_i^p(p_1, p_2)$: customers getting priority in firm i.
- $n_i^r(p_1, p_2)$: customers getting regular service in firm i.
- $n_i(p_1, p_2) = n_i^p(p_1, p_2) + n_i^r(p_1, p_2)$: total measure of customers in firm i
- $n_1(p_1, p_2) + n_2(p_1, p_2) = 1$

Proposition 4:

- In a unique pure strategy subgame perfect equilibrium prices are $(1/4, 1/4)$ and
- ${n_1}^p(p_1, p_2) = {n_2}^p(p_1, p_2) = 1/2$
  - The two firms provide no surplus with the priority service but extract the monopoly price from their customers!
- Customers' joint welfare gain can be negative also under competition

Model 4: 2 Service Providers/Heterogeneous Customers



Equilibrium Conditions

1. Type with waiting costs ${c_{1,2}}^p$ must be indifferent between getting priority service from firm 1 and firm 2.
2. Both firms' non-priority service has same waiting time.
3. Type with waiting costs $c^{p,np}$ indifferent between priority service from firm 2 and any non-priority service
4. (Consistency) There is a mass of ${\alpha_1}^p$ with costs equal or higher than ${c_{1,2}}^p$
5. $${\alpha_1}^p + {\alpha_2}^p + {\alpha_1}^{np} + {\alpha_2}^{np} = 1$$

Proposition 5:

- In a Bertrand competition over prices for priority service the firms always extracts positive profits.

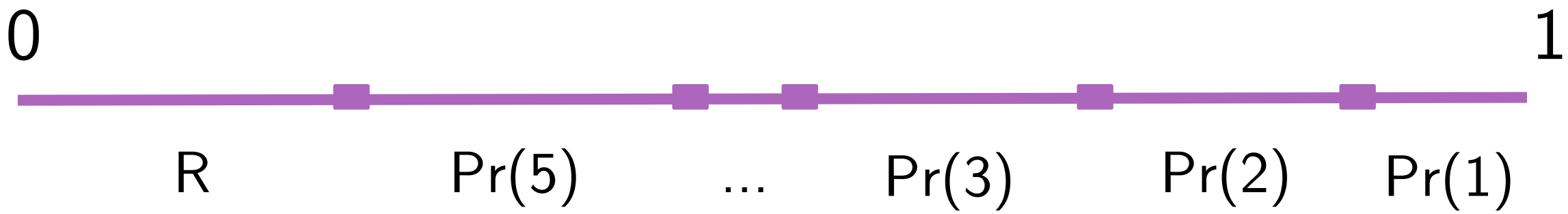
Proposition 6:

- If $F(x) = x^{\theta}$ for $\theta \geq 0$, then customers are better off without priority service.
- In particular, this is the case under uniform distribution of the cost.

- Conjecture (verified by examples) this is also the case for $\theta \geq 1$.

Model 5: Multiple Priorities

- Motivation: Maybe with a sufficient number of PS levels as the efficiency gains grow the server would be compelled to leave some of these gains for the customers.



Proposition 7:

- Assume that the distribution F satisfies the IFR assumption.
- Then, as $k \to \infty$ the regime with no priority service yields a higher total welfare for the customers than one with priority service regime of k classes.

Not Price Discrimination (PD)

- Unlike PD, the monopoly excessive revenue builds on the negative externalities among customers, and
- the fact that the "good" called priority is less valuable the more people purchase it.
- The degree of surplus extraction is typically greater than the customers' total surplus itself.
  - This can never happen in a standard monopoly framework with or without price discrimination.

Not Price Discrimination (PD)

- Excessive power of service providers remains also when we depart from the monopolistic market structure, and introduce competition.
  - This again won't be the case with price discrimination of any degree.

Market Power

- "Market power arises where an undertaking does not face sufficiently strong competitive pressure." (EC Competition Act 1998)

Why Does PS Erode Competition

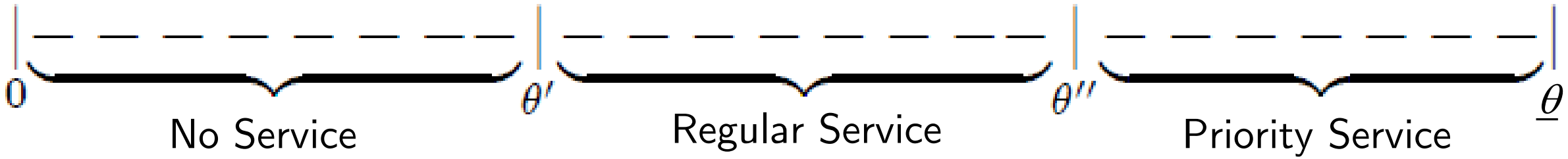
- If the price of PS is substantial, why won't one of the servers reduce its price to extract more customers?

- Because by expanding his clientele he will reduce the quality of the service and will cause the marginal customer to leave to the other service provider.
- So, PS implicitly facilitates (tacit) collusion.

Model 6: Endogenous Pricing for the Basic Service

- $\theta \in [0, \underline{\theta}]$ is a set of types; F is a CD on $[0, \underline{\theta}]$
- The type determines both the value $v(\theta)$ and the cost per unit of time $c(\theta)$.
- The monopolist set two prices $p \in \{p_r, p_p\}$
- Buying the service yields utility $v(\theta) - c(\theta)t - p$
  - Let $v > 0$, $c > 0$, $v' > 0$, $c' > 0$
- Case I: $v' - c' > 0$ (Low value excluded!)
  - the dominant effect of types is on v
- Case II: $v' - c' < 0$ (High cost excluded!)

Low Value Exclusion



Low Value Exclusion

- Example:
- $v(\theta) = \theta$ and $c(\theta) = \delta\theta$

High Cost Exclusion

Results

- Introducing priority service always increases the provider's revenues.
- Substantial expansion of consumption due to PS will tend to increase consumers' welfare.
- Low Value Exclusion is more conducive for the increase of consumer' welfare due to PS (relative to High Cost Exclusion).

Results

- Under High Cost Exclusion the negative effect of PS can be dramatic:
- If there is no consumption expansion, then
- for much of the known distribution PS would not only reduce welfare at the aggregate level, but
- even on the individual basis –
  - due to increase of both the price of the basic service as well as the price of priority.

Model 7: Non-Linear Cost Function

- We study the monopolistic case with heterogeneous consumers.
- Result extend for both the convex and the concave cost functions.

Main Conclusions

- PS can be extortionary in monopoly markets and can erode competition in oligopolies.
  - If the basic service is free or if it's price is fixed this is always the case (under mild conditions).
  - If the price of the regular service is endogenous PS can increase welfare and loss of welfare is more prevalent in cases where high cost types are excluded from consumption.
- An Isomorphic Problem is the one involving a private service that emerges to supplement a public one
  - Example: Health, Education

Main Conclusions

- A possible remedy is to auction the PS and compensate losers for their extra waiting time.
- Possible Extensions:
  - a general model of contracting with negative externalities among consumers
  - (conspicuous consumption, more general consequences of congestion, and more)

Competition Policy

- Elicit willingness to pay for PS if these have low variance across agents then the overall loss of welfare is large (because the efficiency gain is low)

Thanks