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Ticket pricing and the impression of excess demand

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ABSTRACT

If willingness to pay depends on characteristics of other attendees, a monopolist will use a lineup as a screening mechanism only if a consumer's characteristic is inversely related to her cost of lining up. No capacity constraint is necessary.

1. Introduction

The presence of goods with persistent excess demand has generated a broad literature attempting to rationalize this observation with profit maximization. One thread of this literature builds on Veblen's (1899) observation that one consumer's demand may well depend on the demands of others. For example, Becker (1991) introduces the notion of a "social externality" where a given consumer's demand depends on the *level* of consumption by others. Another thread considers "mob goods", where a consumer's demand depends on the *characteristic* of other consumers (DeSerpa and Faith, 1996). In both strands the monopolist faces a capacity constraint, which leads to equilibrium rationing, i.e. there exist consumers who are willing to pay more than the price of the good but don't obtain it. However, this fact is not included in the consumers' choice problems, making the models inconsistent. Furthermore, capacity constraints suggest a short-run phenomenon.

In our model, as in the second strand of the literature described above, willingness to pay depends on the characteristic of other consumers. A monopolist uses a lineup as a mechanism to screen for consumers with desirable characteristics; no capacity constraint is assumed. In equilibrium, marginal consumers are indifferent between lining up (and purchasing the good) and not. The market clears with respect to the two part pricing scheme, yet there are consumers willing to pay more than the posted price (but not line up), giving the appearance of excess demand and providing scope for scalping.

2. The model

A promoter sells tickets to a unit mass of consumers with unit demand. A consumer's valuation has a private and a common value component. The common value component is based on some characteristic of the other attendees, termed customer quality. Each consumer is characterized by two idiosyncratic and private values, a private valuation and a quality, denoted by v_i and q_i respectively, and normalized to lie in $[0,1]^2$. Consumers are distributed on this unit square according to some probability density, $f(v,q)$. Let $f_V(v)$ and $f_Q(q)$ denote the marginal distributions, and let $f_{V|Q}(v|q)$ and $f_{Q|V}(q|v)$ denote the conditional distributions. Finally, let $\overline{q}$ denote the average quality of attendees. The common value component of a consumer's valuation is denoted $e(\overline{q})$.

The good is sold via a two part pricing system: a monetary price, p, and a lineup, ℓ.[1] Each potential customer has a money-equivalent cost for ℓ which may depend on the consumer's quality, denoted by $C(\ell, q)$. We assume that cost is increasing in line length, $C_\ell(\cdot) > 0$, and that higher quality consumers also have a lower cost of lining up, $C_q(\cdot) \leq 0$. The latter assumption reflects the idea that fans who contribute more to the

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[1] While we call the non-monetary component a lineup, any procedure a customer has to follow in order to purchase a ticket would qualify if it generates some disutility. In this sense, the promoter is essentially selling a damaged good. In contrast to Deneckere and McAfee (1996), it is the only good sold.

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experience may be better able to clear, or mind less, any non-monetary hoops required to purchase tickets.

3. Analysis

The promoter maximizes profits, $\Pi(p,\ell)=(p-c)N(p,\ell)-F$, by choosing (p,ℓ), where c is the (constant) marginal cost of an additional ticket sale, F denotes fixed costs, and $N(p,\ell)$ is the quantity demanded. The first order conditions are

$$\frac{\partial\Pi(\cdot)}{\partial p}=(p-c)\frac{\partial N(\cdot)}{\partial p}+N(\cdot)=0 \tag{3.1}$$

$$\frac{\partial\Pi(\cdot)}{\partial \ell}=(p-c)\frac{\partial N(\cdot)}{\partial \ell}\le 0 \tag{3.2}$$

where Eq. (3.2) holds with equality if the optimal level of ℓ is positive. A necessary condition for the promoter to choose $\ell>0$ is $\partial N(\cdot)/\partial\ell>0$ for some ℓ. That is, aggregate demand must be increasing in the lineup length at least somewhere.

In a rational expectations equilibrium, customers who expect a common value of $e(\overline{q})$ will purchase a ticket at price p with line length ℓ if their individual (v_i,q_i) is such that they receive non-negative surplus:

$$v_i+e(\overline{q})-p-C(\ell,q_i)\ge 0. \tag{3.3}$$

The private valuation of the marginal customer with customer quality q is given by $\underline{v}(q)=p-e(\overline{q})+C(\ell,q)$. Since $\underline{v}'(q)=C_q(\ell,q)\le 0$, marginal customer valuation is decreasing in customer quality.

The number of customers and average quality are found by simultaneously solving:

$$N=\int_0^1\int_{p-e(\overline{q})+C(\ell,q)}^1 f(v,q)\,dv\,dq \tag{3.4}$$

$$\overline{q}=\frac{1}{N}\int_0^1\int_{p-e(\overline{q})+C(\ell,q)}^1 q f(v,q)\,dv\,dq. \tag{3.5}$$

Assume a unique solution, $N(p,\ell)$ and $\overline{q}(p,\ell)$, to this system and denote the determinant of the Jacobian by $|J|$. The partial derivatives of $N(p,\ell)$ and $\overline{q}(p,\ell)$ with respect to p are

$$\frac{\partial N(p,\ell)}{\partial p}=-\frac{\int_0^1 f(\underline{v}(q),q)dq}{|J|}<0 \tag{3.6}$$

$$\begin{aligned}\frac{\partial\overline{q}(p,\ell)}{\partial p}&=\frac{\int_0^1 q f(\underline{v}(q),q)\,dq}{N(p,\ell)|J|}\\&\quad-\frac{\left(\frac{1}{N(p,\ell)}\int_0^1 f(\underline{v}(q),q)dq\right)\left(\int_0^1\int_{\underline{v}(q)}^1 qf(v,q)dv\,dq\right)}{N(p,\ell)|J|}\\&=\frac{\{E[q|v=\underline{v}(q)]-\overline{q}\}\int_0^1 f(\underline{v}(q),q)dq}{N(p,\ell)|J|}.\end{aligned} \tag{3.7}$$

An increase in p therefore always decreases attendance, while the effect of price on average quality is ambiguous. However, if v and q are independent $(f(v,q)=f_V(v)f_Q(q))$ then an increase in p has no effect on average quality.

The effect of ℓ on $N(p,\ell)$ and $\overline{q}(p,\ell)$ is more complex since it depends on $C_{q\ell}(\cdot)$ as well as the statistical correlation between v and q:

$$\begin{aligned}\frac{\partial N(p,\ell)}{\partial\ell}=-\frac{1}{|J|}\Bigg[&\int_0^1 C_\ell(\cdot)f(\underline{v}(q),q)dq\\&-\frac{e'(\overline{q})}{N(p,\ell)}\int_0^1 qf(\underline{v}(q),q)dq\int_0^1 C_\ell(\cdot)f(\underline{v}(q),q)dq\\&+\frac{e'(\overline{q})}{N(p,\ell)}\int_0^1 f(\underline{v}(q),q)dq\int_0^1 qC_\ell(\cdot)f(\underline{v}(q),q)dq\Bigg]\end{aligned} \tag{3.8}$$

$$\frac{\partial\overline{q}(p,\ell)}{\partial\ell}=-\frac{\int_0^1 qC_\ell(\cdot)f(\underline{v}(q),q)dq-\overline{q}\int_0^1 C_\ell(\cdot)f(\underline{v}(q),q)dq}{N(p,\ell)|J|}. \tag{3.9}$$

Intuitively, if the marginal cost of a lineup to the consumer does not depend on the consumer's quality, a lineup cannot screen for quality. Indeed, if $C_{\ell q}(\cdot)=0$, Eq. (3.9) simplifies to

$$\frac{\partial N(p,\ell)}{\partial\ell}=-\frac{C_\ell(\cdot)}{|J|}\int_0^1 f(\underline{v}(q),q)\,dq<0 \tag{3.10}$$

and following the earlier results, the promoter would never use a lineup when maximizing profits. Of course, if the marginal cost of a lineup is actually increasing in quality, the line would lead to negative selection and is clearly useless.

Proposition 1. *A necessary condition for a profit maximizing promoter to use a lineup is that consumers' marginal cost of lining up is negatively related to their customer quality. Formally,* $\ell^*>0\Rightarrow C_{\ell q}(\cdot)<0$.

While there must be a (negative) relation between the cost of lineup and customer quality, there does not have to be any relation between a consumer's customer quality and her willingness to pay. This is in contrast to DeSerpa and Faith (1996) where quality and valuation must be inversely related.

Proposition 2. *A negative correlation between customer quality* q_i *and private valuation* v_i *is not necessary for the promoter to use a lineup.*

This proposition is proved via an example. Suppose v and q are independent and distributed uniformly on the unit square. Let the common value of a concert be $e(\overline{q})=\alpha\overline{q}$, $\alpha\le 2$ and let the cost function be $C(\ell,q)=(1-q)\ell$. Without a lineup the average quality is 1/2, independent of price, and profits are maximized at $p=1/2+\alpha/4$, yielding a profit level of $\Pi(l=0)=(2(1-c)+\alpha)^2/16-F$.

With a lineup, $\underline{v}(q)=p-\alpha\overline{q}+(1-q)\ell$ defines a linear relationship between q and v for the marginal consumers, with $\partial v/\partial q=-\ell$. Suppose that the promoter chooses $\ell=2$ and $p=5\alpha/6-F$. The mass of consumers who purchase a ticket is 1/4 while the average quality is 5/6. The promoter's profits in this scenario are therefore $5\alpha/24$. These profits are greater than without a lineup when

$$\alpha\in\left(\frac{6c-1-\sqrt{24c-35}}{3},\frac{6c-1+\sqrt{24c-35}}{3}\right). \tag{3.11}$$

For example, if $c=2$ and $F=0$, then the promoter makes greater profits from this lineup and price pair when $\alpha\in(2.4,4.8)$, approximately. If $\alpha=4$, for example, the promoter has profits of 1/4 without a lineup and profits of 1/3 with this particular lineup. While this is not the optimal profit (the derivation of which is tedious but essentially uncomplicated), it clearly exceeds the profit without the lineup, proving the point.

4. Discussion

It is worth noting that there exist consumers willing to pay the posted price—but not willing to line up. This creates an opportunity for resale and hence the appearance of excess demand. Specifically, consumers with high valuation but low quality are willing to offer enough money to induce ticketholders to sell. If such sales are allowed, the screening effect of the lineup will be undone. If resale is constrained to occur at face value, then ticketholders will not sell. Anti-scalping legislation therefore can improve welfare.

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References

Becker, Gary S., 1991. A note on restaurant pricing and other examples of social influences on price. Journal of Political Economy 99 (5), 1109–1116.
Deneckere, Raymond J., McAfee, R. Preston, 1996. Damaged goods. Journal of Economics & Management Strategy 5 (2), 149–174.
DeSerpa, Allan C., Faith, Roger L., 1996. Bru-u-u-uce: the simple economics of mob goods. Public Choice 89 (1–2), 77–91.
Veblen, Thorstein (1899) *The Theory of the Leisure Class*, London; Unwin Books; reprinted Amherst, NY: Prometheus Books.