Eliciting demand information through cheap talk: An argument in favor of a ban on price discrimination

Lars Frisell [a,*], Johan N.M. Lagerlöf [b,1]

[a] *Sveriges Riksbank, Brunkebergstorg 11, 103 37 Stockholm, Sweden*
[b] *University of Copenhagen, Denmark, and CEPR*

Abstract

A uniform pricing rule may enable the communication of demand information from buyer to seller in situations where this would not have been possible if the seller could price discriminate. Importantly, such a rule can benefit both buyer and seller.
© 2007 Elsevier B.V. All rights reserved.

Keywords: Price discrimination; Welfare; Uncertainty; Incomplete information; Cheap talk

JEL classification: D82; L11; L42

1. Introduction

Antitrust policy has traditionally been very strict about price discrimination, sometimes even treating it as a per se offense. According to European competition law (specifically, Article 82 of the EC Treaty) it constitutes an abuse for one or several firms having a dominant position to apply "dissimilar conditions to equivalent transactions with other trading parties, thereby placing them at a competitive disadvantage". In this judicial tradition, price discrimination is considered to be unfair because some buyers must pay a higher price than others for an equivalent good or service, unless the price differential is motivated by cost differences.[2]

The early economics literature focused on the exploitative effects of price discrimination, i.e., that it allows dominant firms to increase profits at the expense of consumers. It also stressed that the allocation of output tends to be inefficient when different consumers meet different prices.[3] However, more recent economic analysis has characterized circumstances under which price discrimination can increase both total welfare and consumer welfare. This may occur since allowing price discrimination may lead to higher output. The reason is that when sellers are forced to use linear pricing, they may (optimally) set prices so high that buyers with low valuation for the good are completely left out of the market. Today the prevailing view among economists seems to be that, although the welfare effect of price discrimination in general is ambiguous (Schmalensee, 1981; Varian, 1985), non-discrimination rules probably do more harm than good.

In this paper we bring forth a new argument in support of a ban on price discrimination in an incomplete-information environment. We show that a uniform pricing rule, which guarantees all (active) buyers a strict surplus, may enable information sharing between buyer and seller. Such communication increases welfare in two ways: it increases the probability of (efficient) production in instances where demand is high, and reduces the probability of (wasteful) production when demand is low. Moreover, the welfare gain may not accrue only to

---

* Corresponding author. Tel.: +46 87870275, fax: +46 8210531.
E-mail address: lars_usa@yahoo.com (L. Frisell).

[1] The second author thanks Royal Holloway, University of London, UK, where a large part of his work on this article was carried out.

[2] For an in-depth discussion of price discrimination under EC competition law, see Geradin and Petit (2005). For a discussion of the fairness concept and price discrimination, see Gehrig and Stenbacka (2005).

[3] For example, in the case of linear demand and constant returns to scale, it has been shown that, if all markets (customers) are served under linear pricing, allowing price discrimination strictly reduces welfare (Schmalensee, 1981).

buyers, which means that a ban on price discrimination may also be preferred by the seller. That is, a non-discrimination rule, properly enforced by the judicial system, constitutes a commitment device that sellers may be unable to achieve on their own.

Most closely related to the current paper is Farrell and Gibbons (1995). The authors consider a producer's problem of eliciting investment-specific information from a buyer. They show that reducing the producer's ex post bargaining power may enhance efficiency as the buyer's incentive to reveal his private information is increased. The authors also show that the gain in communication may outweigh the loss from the increased hold-up problem.

2. A simple model

A firm has the opportunity to produce a new good. There is no other firm that can do this, so if the firm produces it becomes a monopolist. A production decision implies a fixed start-up cost F, which is unknown at the outset. There is also a constant marginal cost of production, c, which is normalized to zero. The fixed cost may stem from setting up new machinery or infrastructure, training new staff, etc., and is sunk once incurred. There is a single buyer (or buyer representative). The buyer's utility function is $vq - \frac{1}{2}q^2 - T$, where v is the buyer's type, q is the quantity bought, and T is the total transfer paid to the firm.[4] Note that with fixed unit price (linear pricing), demand is linearly decreasing in price, $q(p) = v - p$, as long as demand is positive.

The game proceeds as follows. In the first, "constitutional" stage of the game, the supplier chooses whether or not to commit to linear pricing. The buyer's and seller's types (v and F) are then realized. The buyer's type is private information to the buyer, such that $v \in \{v_L, v_H\}$ and $v_H > v_L > 0$. The common prior is that $v = v_H$ with probability μ and $v = v_L$ with probability $1 - \mu$. In turn, the fixed cost is private information to the firm. The common prior distribution is $G(F)$, where G is differentiable and has density $g(F) > 0$ for all $F \in [0, \bar{F}]$ and $g(F) = 0$ for all $F \notin [0, \bar{F}]$, $\bar{F}$ finite. In what follows we shall often consider the uniform case $g(F) = 1 / \bar{F}$. We assume that $\bar{F} \geq v_H^2 / 2$, which implies that the cost density is strictly positive over the entire profit range, which simplifies the exposition.

The buyer then sends a (possibly uninformative) message "Low" or "High," meaning $v = v_L$ and $v = v_H$, respectively, to the firm. Messages are cheap talk. Given the message and the observed cost, the firm then decides whether to produce or not, and what price or price-quantity bundles to offer. Finally the buyer makes his consumption decision, and payoffs are realized. For brevity we only compare two pricing regimes, linear pricing and unrestricted (second-degree) price discrimination. This is sufficient to illustrate the firm's trade-off between improved ex ante communication and smaller ex post surplus.

3. Linear pricing

Consider the situation where the seller commits to use linear prices. We first have to make sure that both buyer types have an incentive to report truthfully; if either type preferred to misreport the firm would gain no information relative to its prior, and would never choose the linear pricing regime.[5] From the quadratic utility function we have that, conditional on a truthful message v_i, the firm optimally sets price $v_i / 2$, sells quantity $v_i / 2$ and makes gross profit $v_i^2 / 4$. This means in turn that, in a truthful equilibrium, the firm produces if and only if $F \leq v_i^2 / 4$.

The surplus for a type i buyer, if the firm believes he is of type j, is $\frac{1}{2}\left(max\left(v_i - \frac{v_j}{2}, 0\right)\right)^2$. Therefore, type i will reveal his type truthfully as long as

$$\frac{v_i^2}{8} G\left(\frac{v_i^2}{4}\right) \geq \frac{1}{2}\left(max\left(v_i - \frac{v_j}{2}, 0\right)\right)^2 G\left(\frac{v_j^2}{4}\right), \ i \neq j. \quad (1)$$

For $2v_i > v_j$, these incentive constraints are not automatically satisfied. In particular, if $2v_L > v_H$ and the gain in production probability is sufficiently large, the low type might actually prefer to exaggerate his valuation. However, when $G(\cdot)$ is uniformly distributed and $2v_i \geq v_j$, Eq. (1) reduces to

$$v_i^4 \geq v_j^2 \left(2v_i - v_j\right)^2.$$

Taking square roots (both sides are positive) reduces the inequality to $(v_i - v_j)^2 \geq 0$. Hence, in the uniform case the incentive constraints always hold.

Since the firm only produces if expected revenues are greater than the realized start-up cost, its ex ante expected profit is, given a truthtelling equilibrium,

$$
(1 - \mu) \int_0^{v_L^2/4} \left(\frac{v_L^2}{4} - F\right) dG(F)
$$
$$
+ \mu \int_0^{v_H^2/4} \left(\frac{v_H^2}{4} - F\right) dG(F)
$$
$$
= (1 - \mu) \int_0^{v_L^2/4} G(F) dF + \mu \int_0^{v_H^2/4} G(F) dF, \quad (2)
$$

where the last step is derived through integration by parts.

4. Price discrimination

When there is no ban on price discrimination, the buyer has clearly no incentive to reveal his type since the firm would extract all surplus. Hence, the firm necessarily faces uncertainty about the buyer's type. There are now two possibilities: either it is optimal for the firm to offer a menu such that both buyer types purchase a positive quantity, or it optimally serves only the high type.

---

[4] The quadratic utility function is chosen for analytical simplicity, but we expect our qualitative results to hold for any utility function that exhibits strictly decreasing marginal utility. As long as this holds, linear pricing leaves the consumer with a positive surplus and gives the high type a certain incentive to reveal his type in order to increase the probability of production.

[5] For simplicity we restrict attention to pure-strategy equilibria. Moreover, as in any cheaptalk game, there exists an equilibrium in which there is no information transmission at all, a so-called babbling equilibrium. We will disregard all babbling equilibria and restrict our attention to the equilibrium in which both buyer types report truthfully.