Unpriced Quality

Pascal Courty[1]

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Abstract: A monopolist deliberately charges the same price for differentiated products when high quality products are more likely to be allocated to low type consumers under uniform pricing. The argument can explain the use of 'unpriced quality' for concert tickets, sport events, and in many other situations.

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[1] Pascal Courty, Department of Economics, European University Institute, Villa San Paolo, Via Della Piazzuola 43, 50133 Firenze, Italy, Pascal.Courty@IUE.it.

Firms sometimes charge the same price for products of different qualities. In the absence of price discrimination, high quality products, which are preferred by all consumers, end up being rationed. Examples include tickets for seats of different quality for sports and music events. Connolly and Krueger (2006) report that 43 percent of concerts for popular music in 2003 sell all seats in the house at the same price. Consumers also have to wait to enjoy the most popular attractions in theme parks (Passell, 1995). Restaurants do not charge extra to those consumers who come during peak hours or peak days. Movie theaters do the same and in addition they do not charge more for blockbusters (Einav and Orbach, 2007). Finally, grocery stores often do not differentiate fresh products and the most appetizing qualities sell first while the last consumers pay the same price for inferior, old, or stale products. In all these examples, quality is unpriced; that is, higher quality products are sold at the same price as lower quality ones.

In this paper, we show that uniform pricing can dominate price discrimination even when there is no additional cost associated with implementing price discrimination. We start with the standard model of second degree (quality) price discrimination (Mussa and Rosen, 1978). To simplify the analysis, we take the distribution of goods as given. This assumption is reasonable in all the examples above, and allows us to focus on revenue considerations alone, in studying the trade off between uniform pricing and price discrimination.[2]

Whether uniform pricing dominates price discrimination depends on how goods are allocated under uniform pricing. Uniform pricing is more likely to be optimal under a reverse monotone allocation rule, which assigns high quality goods to low type consumers. This allocation rule is reasonable in all the applications mentioned above. It is consistent with a rationing mechanism based on queues, for example, if the time value of the good decreases with consumer type (Holt and Sherman, 1982). In addition, uniform pricing will dominate price discrimination when there are not too many high types and when high types do not value incremental units of quality too much relative to low types (so that rationing is not too inefficient).

Despite the extensive economic literature on price discrimination, there is surprisingly little work on why firm sometimes abstain from price discriminating (Stole, 2008). Anderson and Dana (2008) study when the optimal product line dominates selling a unique product quality. Instead, we take the product line as given and investigate whether the firm wants to sell differentiated products at different prices. Miravete (2007) shows that the return to complex tariffs may be low and implementation costs could explain the prevalence of simple product lines. We show that uniform pricing can dominate price discrimination even in the absence of implementation costs.

This paper also contributes to the literature demonstrating that rationing may be more effective at extracting consumer surplus than market clearing (e.g. Gilbert and Klemperer, 2000). An important implication of our analysis is that under uniform pricing the monopolist will strictly favor allocation rules that are more likely to assign high quality goods to low types. A queuing system may support this assignment, but more generally, the seller may also manipulate the release date, opening hours, payment method, or other features of the allocation process that differentially increase the cost that high types have to bare to obtain high quality products.

1-Example

Assume there are two types of consumer, two types of good, and each consumer can consume at most one good. Consumer t=L,H values v^t_s a good of quality s=l,h such that

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[2] Since we ignore cost issues, selling different goods at different prices corresponds to

$v^t_h > v^t_l$, $v^H_s > v^L_s$, and $v^H_h - v^H_l > v^L_h - v^L_l$. All consumers value the high quality good more, the high type values any quality more than the low type, and the high type values an increment in quality more than the low type. In addition, we also assume that $v^H_l > v^L_h$. There are $\phi \in [1/2,1]$ high type consumers and $1-\phi$ low types. There is a unit continuum of goods. To simplify, we assume that the fraction of high quality goods is equal to ϕ and we show later that the results generalize. Under price discrimination, the monopolist fully extracts the surplus of the low type consumers, $p_l = v^L_l$, binds the incentive compatibility constraint of the high types, $p_h = v^L_l + (v^H_h - v^H_l)$, and earns revenue

$$R^d = v^L_l + \phi(v^H_h - v^H_l).$$

Under uniform pricing, we assume that the goods are allocated according to an inverse monotone allocation rule: high quality goods are first allocated to low types. Under uniform pricing, the monopolist charges v^L_h and earns profits $R^u = v^L_h$ (there are enough high quality goods for the low types and high types buy since $v^H_l > v^L_h$).[3] The gains from using uniform pricing instead of price discrimination, $\Delta R = R^u - R^d$, can be expressed as $\Delta R = v^L_h - v^L_l - \phi(v^H_h - v^H_l)$. The monopolist uses uniform pricing when this expression is positive, that is, when

$$(v^H_h - v^H_l)/(v^L_h - v^L_l) < 1/\phi. \quad (1)$$

This condition is more likely to hold for low fractions of high types and when high types do not value quality much more than the low types, so that rationing is not too inefficient. The intuition is that the reverse monotone allocation rule increases the willingness to pay of the low types more than what is lost from the high types under price discrimination.

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price discrimination (Clerides, 2004).

[3] Because rationing is deterministic, the monopolist could earn more by charging more for low quality goods but this odd prediction does not carry through when rationing is random (see next section).

Next, we generalize the analysis to a continuum of consumers and goods and to arbitrary rationing rules.

2-Analysis

There is a unit mass of consumer with type distribution F(t), $t \in [t^L, t^H]$. The monopolist has to price a given continuum of goods of quality distributed according to G(q), $q \in [q_l, q_h]$. Consumer t gets utility $U^t(q)$-p from buying a good of quality q at price p, where $U^t_q>0$, $U^t_{qq}<0$, and $U^t_{tq}>0$. The single crossing condition implies that it is efficient to allocate higher quality goods to higher types. Denote the efficient allocation $t^e(q)$ defined by $F(t^e(q))=G(q)$. We assume that under price discrimination there is full market coverage.[4]

Under uniform pricing, consumers buy a lottery over quality. The probability density that type t receives a good of quality q is $\pi^t(q)$ with associated distribution $\Pi^t(q)$. The lotteries $\pi^t()$ are given. The rationing rule is such that market clearing takes place, $\int^{tH}_{tL}\pi^t(q)dt=g(q)$, for all q. In addition, we assume

$$\int_{q_l}^{q_h} \pi^t(q)U^t(q)dq \geq \int_{q_l}^{q_h} \pi^L(q)U^L(q)dq \quad \text{for all t} \qquad \text{(A1)}$$

This condition guaranties that under uniform pricing all types participate if the lowest type does.[5]

Under price discrimination, denote the pricing rule p(q) and the profit maximizing allocation rule $t^{pd}(q)$. The participation constraint of consumer t^L, $p(q_l)= U^L(q_l)$, together with the consumers' first order conditions, $U^t_q(q)=p_q(q)$, define the pricing rule as a function of the allocation rule

[4] A sufficient condition for full market coverage is $U^L(q_l)>(1-F(t))U^t(q(t))$ for all t where $q(.)=(t^e)^{-1}(.)$. This condition implies that serving $[t^L,t^H]$ dominates serving only $[t,t^H]$ for any t.

[5] This condition holds under a reverse monotone allocation if $U^t(q'(t))> U^L(q_l)$ for all t where q' is defined by G(q'(t)=1-F(t).

$$p(q) = U^L(q_l) + \int_{q_l}^{q} U_q^{t^{pd}(q)}(q)dq.$$

Taking full derivatives in the consumer first order condition with respect to t implies that $t^{pd}(q)$ is increasing, which together with full market coverage, implies $t^{pd}(q)=t^e(q)$. After integration, we obtain the revenue under price discrimination

$$R^{pd} = \int_{q_l}^{q_h} \left(U^L(q_l) + \int_{q_l}^{q} U_q^{t^e(x)}(x)dx \right) g(q)dq$$

and after integration by parts, we get

$$R^{pd} = U^L(q_l) + \int_{q_l}^{q_h} U_q^{t^e(q)}(q)(1-G(q))dq.$$

Under assumption A1, the optimal uniform price is $\int_{q_l}^{q_h} \pi^L(q)U^L(q)dq$ with profits

$$R^u = \int_{q_l}^{q_h} \pi^L(q)U^L(q)dq$$

Uniform pricing weakly dominates price discrimination if and only if $R^U \geq R^{PD}$

$$\int_{q_l}^{q_h} \left(\left(1-\Pi^L(q)\right)U_q^L(q) - \left(1-G(q)\right)U_q^{t^e(q)}(q) \right) dq \geq 0. \qquad (2)$$

This establishes our main result which we now discuss. Under a reverse monotone allocation rule the lowest type gets the highest good for sure, $\Pi^L(q)=0$ for all $q<q_h$, and condition (2) becomes

$$\int_{q_l}^{q_h} \left(U_q^L(q) - \left(1-G(q)\right)U_q^{t^e(q)}(q) \right) dq \geq 0$$

which is the continuous version of (1). A sufficient condition for uniform pricing to be optimal is

$$\frac{1-\Pi^L(q)}{1-G(q)} \geq \frac{U_q^{t^e(q)}(q)}{U_q^L(q)} \quad \text{for all } q\in[q_l,q_h]. \qquad (3)$$

Again, this condition is equivalent to condition (1) in the two type case with an inverse monotone allocation rule. In general, it is less likely to hold if there is a large fraction of high types (first-order-stochastic-dominance shift in G(.)), if the allocation rule is closer to reverse monotone (first-order-stochastic-dominance shift in $\Pi^L(.)$), and if higher types are not willing to pay much more than the lowest type for incremental units of quality so that rationing inefficiencies are not too high (the ratio on the right hand side of inequality (3) is small). Any allocation rule away from reverse monotone reduces the chance that uniform pricing is optimal. For example, under a random allocation rule, $\Pi^t(q)=G(q)$, condition (2) is violated, and price discrimination is preferred.

In a market with no consumer heterogeneity at all, price discrimination and uniform pricing are equivalent. Price discrimination dominates uniform pricing when there much consumer heterogeneity (condition (2) is violated). Therefore, uniform pricing can be strictly optimal when there is some consumer heterogeneity but not too much.

From a welfare point of view, three points deserve mention. When uniform pricing is optimal, the allocation of goods is inefficient. In fact, mandating the firm to use price discrimination would implement the first-best allocation rule. In addition, uniform pricing may generate queuing inefficiencies (which are not captured in the current model). Finally, total consumer welfare decreases since overall welfare decreases and firm revenue increases. Some consumers, however, may be better-off.[6]

3-Conclusions

The price discrimination literature has overlooked the possibility to deliberately sell vertically differentiated products at the same price. Our analysis proposes a rationale for observing 'unpriced quality' in environments where price discrimination does not entail any additional implementation costs and should, according to standard theory, dominate uniform pricing.

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[6] This will be the case if $\int_{q_l}^{q_h}\left(\pi^t(q)U^t(q)-\pi^L(q)U^L(q)\right)dq > U^t(q(t))-p(q(t))$ where $q(.)=(t^e)^{-1}(.)$.

We assumed that the set of goods was given and focused on the monopoly revenue maximization problem. The analysis could be extended to endogenous product qualities. Clearly, the results hold for cost functions that sufficiently constrain the monopolist's choice of product line, so that the profit maximizing product line satisfies condition (2). Whether the analysis extends to general cost functions is an interesting question for future research.

References

Anderson, Eric and James Dana. (2008). "Integrating Models of Price Discrimination." Mimeo, Northwestern.

Connolly, Marie and Alan B. Kruger (2006), "Rockonomics: The Economics of Popular Music." Handbook of the Economics of Art and Culture.

Clerides, Sofronis. (2004). "Price Discrimination with Differentiated Products: Definition and Identification." Economic Inquiry 42(3), 402-412.

Einav, Liran and Orbach, Barak. (2007). "Uniform Prices for Differentiated Goods: The Case of the Movie-Theater Industry." International Review of Law and Economics, 27(2), 129-153.

Gilbert, Richard and Paul Klemperer. (2000). "An equilibrium theory of rationing." RAND Journal of Economics. 31, 1-21.

Holt, Charles, and Roger Sherman. (1982). "Waiting-Line Auctions." Journal of Political Economy. 90, 280-94.

Miravete, Eugenio. (2007). "The Limited Gains from Complex Tariffs." CEPR Discussion Paper No. 4235.

Mussa, M., and S. Rosen (1978) "Monopoly and Product Quality," Journal of Economic Theory 18: 301-317.

Passell, Peter. "Economic Scene; Disneyland and the old U.S.S.R.: Sharing something in common." New York Time, April 27, 1995.

Stole, Lars. "Price Discrimination and Competition." In M. Armstrong and R. Porter: Handbook of Industrial Organization, Volume 3. Amsterdam: Elsevier, 2007. 2221-99