

Babu Nahata
Krzysztof Ostaszewski
Prasanna Sahoo

University of Louisville

Buffet Pricing*

I. Introduction

There is a type of pricing that is prevalent and has interesting policy implications, as in the design of a national health insurance system, the fare structures of subway networks, and the use of the Internet. However, it has not been seriously considered in the literature and has even escaped mention in the standard textbooks. The most striking feature of this form of pricing is that, in spite of the fact that the seller's cost depends on the quantity, the price (or the entry fee) charged to a consumer is independent of the quantity consumed. Perhaps the most obvious example of this form of pricing is the "all-you-can-eat" buffet for a fixed entry fee. Since neither the linear nor the nonlinear classification adequately explains this form of pricing, we label this "no-limit-on-

This article analyzes a commonly used pricing practice, which we call "buffet pricing," in which for a fixed entry fee consumers can consume an unlimited quantity during a specified period of time.

When consumers are homogeneous in preferences, this form of pricing can be more profitable than a two-part tariff if the total cost under a two-part tariff is greater than the "net" total cost under buffet pricing. For heterogeneous consumers, depending on the distribution of consumer types and the relative magnitudes of transaction and production costs, buffet pricing can also be more profitable than two-part tariffs.

* We thank an anonymous referee, Douglas Diamond, and an editor of the journal for insightful comments and suggestions. We also are grateful to Masahiro Abiru, John Formby, Seung-Hoon Lee, Steve Martin, Ko Nishihara, Subhashis Raychaudhuri, Fred Siegel, Koichi Suga, John Vahaly, and Mike Waterson for useful discussions, suggestions, and constructive criticisms. Nahata gratefully acknowledges financial support from the Japan Society for the Promotion of Science for a research fellowship at Fukuoka University, Japan, for the 1996–97 academic year. Ostaszewski is grateful for the financial support from the University of Louisville. Earlier versions of the paper were presented at Fukuoka University, Hiroshima Shudo University, and Kagawa University in Japan; at the Kentucky Economic Association meetings in Lexington; at the Econometric Society European meetings in Toulouse; and at the European Association for Research in Industrial Economics meetings in Copenhagen.

(Journal of Business, 1999, vol. 72, no. 2)

© 1999 by The University of Chicago. All rights reserved.
0021-9398/99/7202-0003\$02.50

quantity pricing” as “buffet pricing.”¹ For the purposes of this article, we suggest the generic name of “buffet pricing,” in which not only is the price in the form of an entry fee the same for all customers, but also the price does not depend on the units consumed by a particular consumer. The cost of serving different types of consumers, however, varies.²

The above example is not an isolated case. In many cities in the United States, there is a fixed monthly charge for the local telephone service for all residential customers that does not depend on the number of local calls. This “no-limit-on-number-of-calls” pricing is a form of buffet pricing. In many cities around the world, for example, New York and Moscow, there is one fare for all commuters who use a subway or metro regardless of the distance traveled. The fare is independent of the rider’s destination. In Europe, for a fixed price the Eurail pass allows the holder to travel an unlimited distance in a given period of time. In the health care industry, the employer-provided family medical insurance premium does not depend on the family size. The premium also does not depend on the amount of medical services consumed.³ Thus, a fixed insurance premium can also be viewed as another example of buffet pricing. Yet another example is a fixed entry fee, for most museums and monuments throughout the world, that allows visitors unlimited viewing during the working hours. Finally, Disneyland, which originally used a two-part tariff, later switched to charging only

1. Buffet pricing has been used for almost 200 years in Calcutta and is currently in use in its original form. In the nineteenth century, the Marwaris, a trading community in India from the state of Rajasthan, migrated to Calcutta for business. It was a common practice for the migrants, mostly men, to leave their wives and the rest of their families behind in their hometowns. For these migrants, the meals were provided twice daily by what is known as the *basa* (a cooking facility managed by several cooks also from the same state and located at the rooftop in many buildings in the business district of Burra Bazaar). The *basa* provided vegetarian meals with a fixed menu for a fixed monthly charge with no limit on the quantity of food one could eat. The duration was limited for approximately 2–3 hours during the lunch and dinner hours. Even today, one can eat in a *basa* for a flat fixed monthly charge. A similar facility was also available for migrants in Bombay (now Mumbai).

2. Buffet pricing can be considered a form of price discrimination. In a general textbook definition, price discrimination occurs when the same commodity is sold at different prices. Implicit in this definition is that the cost does not change from customer to customer. The reverse situation, in which price is the same but the costs differ between customers, is also a form of price discrimination. Thus, under a more general definition (due to Stigler), price discrimination takes place whenever $MC_1/P_1 \neq MC_2/P_2$. For a comprehensive recent survey on price discrimination, see Varian (1989). For an excellent treatment of nonlinear pricing, see Wilson (1993). A detailed treatment of price discrimination is provided by Philips (1983).

3. In recent years many insurance policies, in particular those offered by the HMOs, have started requiring some deductible and copayments (usage fee). Although there is a difference between the premiums paid by singles and married persons, the premium for the married persons does not depend on the number of children (the size of the family).

an entry fee. These real-life examples provide the basic motivation for our article; the analysis presented below shows that depending on the savings in transaction cost, charging only a fixed entry fee to all consumers for a good or a service that does not restrict the quantity a buyer consumes in a given period of time can be more profitable compared with other pricing strategies, for example, a two-part tariff.

It is worth noting that a simple monopoly pricing that uses a single uniform price can be viewed as a pricing strategy in which the fixed entry fee (the right to consume) is zero and each consumer pays the same usage fee (the price per unit). The opposite is the case with buffet pricing, in which each consumer pays the same fixed entry fee but the usage fee is zero. Thus, the simple monopoly pricing and buffet pricing represent the two polar, or limiting, cases of a two-part tariff.⁴

In licensing a patent the pricing practices mentioned above are commonly used. The most common practice, about 50% of licensing contracts, is to charge a royalty or a price per unit, similar to a uniform monopoly pricing. Less common is a two-part tariff (40%) or a fixed fee (10%).⁵ In spite of apparent similarities between pricing practices that are used in patent licensing and those compared in this article, there is a significant difference between the two. The demand for a patent is a *derived* demand. The buyer of a patent is a producer. Hence, whether the licensor of a patent will charge a fixed fee or a royalty will depend on the demand for the final product for which the patent is used. The relationship between the final demand and the derived demand of a patent is more complex to model. Our focus in this article is on the pricing strategies used in the final-product market.

The article is organized as follows. Section II describes two real-life situations in which buffet pricing is commonly observed. Section III analyzes the case in which consumers are homogeneous and compares the profitability of buffet pricing with that of a two-part tariff. In Section IV, the case of heterogeneous consumers is analyzed to illustrate the difference between the two cases. Section V concludes with a discussion on effectiveness and limitations of buffet pricing.

4. A distinction between buffet pricing and bundle pricing may be noted. When commodities are bundled together, the seller decides both the items to be bundled together and the quantity of each commodity in the bundle. When buffet pricing is used, the seller decides only what items will be included in the menu, which might be considered a bundle. The buyer then decides how much to consume. Therefore, in commodity bundling the quantity of each item is limited, but in a buffet, there is no such limit on quantity. Another significant difference between the two pricing strategies is that, while the time period of consumption under buffet pricing is restricted, no such restriction applies to bundle pricing. However, one similarity between the two cases is that not all buyers of a bundle or a buffet consume all commodities in a bundle or a buffet. For example, not all buyers of a personal computer use all software programs that are bundled together. Similarly, not all buyers eat all items in a buffet.

5. See Tirole (1988), ch. 10, for a comprehensive discussion of this topic.

II. Buffet Pricing in Practice

This section describes two real-life situations in which buffet pricing is practiced sometimes but is not used at other times. These examples motivate the formal analysis in the next section.

A. *Lunch Buffets*

All-you-can-eat buffets, common in the United States, offer both specific types and varieties of foods. For instance, Pizza Hut offers a pizza buffet during lunch hours. Many restaurants offer salad bars with a wide variety of food choices. This is also the case with buffets at Chinese restaurants. Typically, buffets are common during lunch hours and in the downtown or other business districts. In the business districts during lunch hours, the number of consumers is large and hence the potential size of the market could also be large. As a result, the potential revenue that can be earned with a buffet-style lunch is large. If each customer were to be served individually, not only would the total transaction cost be high, but the number of customers that could be served in the same period of time would also be low. Thus, buffets save on transaction cost. Because buffets place no limit on consumption, the total amount consumed will be large, making the total production cost of food higher. Hence, buffets offer a trade-off between a higher production cost, potentially a higher revenue, and reduced transaction cost.

Although the time for lunch is limited, the restaurant may still face the problem of adverse selection (only those with giant appetites may be attracted). If this problem is significant, buffet pricing may not be profitable. Restaurants that are frequented mostly by big eaters, making the adverse-selection problem significant, can easily switch to regular pricing, as the cost of switching is rather insignificant. During dinner hours, the adverse-selection problem could be more significant because the quantity consumed by each consumer tends to be larger because of a more relaxed and leisurely atmosphere. This could be a reason why the same restaurants that offer buffets during lunch hours do not offer them during dinner hours.

B. *Subway Fares*

Generally, a subway system is a monopoly. Subway networks vary from city to city. In New York, London, Moscow, and Tokyo, there are many lines that allow commuters to travel in many different directions. As a result, many different types of commuters can commute, and the potential size of the market is large. Because of the large number of commuters, many commuter types, and many destinations, the transaction cost of handling the commuters individually becomes significant. Further, the marginal cost of carrying a passenger is small because the

costs are largely fixed. Hence, buffet pricing becomes more appealing in cities such as New York and Moscow. In other cities where buffet pricing is not used, either the subway network is geographically limited or the savings in transaction cost has already been realized. For example, Calcutta (which does not use buffet pricing) has only one line that runs north to south, limiting both the types of commuters and the total number. Hence, the savings in transaction cost may not be large enough to make buffet pricing more profitable. In the case of Tokyo, at each subway station machines dispense only the tickets and the fares from the originating station to all destinations that are posted in the vending area. Each commuter must buy the ticket himself or herself. Since tickets are not sold by the seller, the savings in the transaction cost that provide the economic impetus for buffet pricing has already been realized by the installation of vending machines.⁶

The basic economic trade-off in buffet pricing is simple: potentially higher revenue and savings in transaction cost versus the extra production cost. When the transaction cost is relatively high, and the market size is large, the trade-off can make buffet pricing a more profitable pricing strategy than a two-part tariff.

III. Homogeneous Consumers

Assume all consumers are homogeneous in preferences (and that each consumer consumes the same amount). Although consumers have an option to consume unlimited amounts, consumption only during a limited period leads to satiation. As a result, a consumer's utility functions can be of only certain types. This restriction limits the choice of products for which buffet pricing can be used. Below, we specify a simple utility function that is quadratic in its strictly increasing portion. Once

6. London is an exception. In London, a commuter either can buy a ticket from the vending machines or can purchase it from the ticket booths manned by ticket sellers. The transaction cost of this hybrid system is higher, compared with Tokyo. A recent article, "The London Tube, Down in the Dumps, Is Put for Sale," in the *New York Times* (February 26, 1997), compares London's subway with New York's. New York and London both cover almost the same number of miles of lines (237 vs. 255). Although New York has more than twice the lines (24 vs. 11) and 1.9 times the number of stations (468 vs. 248), London employs 72.7 persons per line per hour of a weekday operation as opposed to New York's 43.3 (London has 60% more employees per hour of operation per line). A large part of this higher rate of employment represents a higher selling or transaction cost. New York has a flat fare of \$1.50, whereas in London it varies from \$1.90 to \$5.15 (pounds were converted to dollars for comparison). Because of the lower fare, New York carries 145,833 commuters per hour on a weekday (8% more riders per hour) as opposed to 135,000 commuters per hour on a weekday in London. A strong opposition from the union possibly is a significant reason that buffet pricing is not used in London.

the utility function reaches a maximum, it remains constant.⁷ The quantity q^* represents the satiation level of consumption. Let the utility function be of type

$$U(q) = q^* - \frac{(q^* - q)^2}{q^*}. \quad (1)$$

If we assume the total utility function W to be additive, the maximization problem can be written as

$$\max W = m + q^* - \frac{(q^* - q)^2}{q^*},$$

subject to

$$y = m + Pq,$$

where W is total utility, m is money spent on all other goods, y is total income, P denotes price per unit, and q is quantity consumed. Writing the Lagrangian and solving first-order conditions, we get

$$q = q^* - \frac{q^*}{2}P, \quad (2)$$

or

$$P = 2 - \frac{2}{q^*}P.$$

Because of the normalization of the utility (demand) function, the inverse demand function given by equation (4) has a numerical intercept. However, the inverse demand function can be generalized to any linear specification of the type $P = a - bq$.

The entry fee ϵ under buffet pricing is the total willingness for pay (TWP) for q^* and is given by

$$\text{TWP} = \epsilon = \int_0^{q^*} \left(2 - \frac{2}{q^*}q \right) dq = q^*. \quad (3)$$

The total profits, π^b under buffet pricing, equal

$$\pi^b = \text{TWP} - cq^* = q^* - cq^*. \quad (4)$$

7. We submit two reasons for this specification. First, it has a satiation level of consumption that is necessary for the practice of buffet pricing. Second, it is analytically tractable and gives a linear demand function. A linear demand, although restrictive, is generally specified for the sake of simplicity in both the empirical and theoretical analyses. Our specification of the utility function does provide a theoretical foundation for a linear demand. Certainly, other types of utility functions can be specified and analyzed (see the Remark below), but those specifications do require more involved calculations without adding much insight.

The entry fee or profits, π^t under a two-part tariff, can be written as

$$\pi^t = \int_0^q Pdq - cq = \int_0^q \left(2 - \frac{2}{q^*}q \right) dq - cq, \quad (5)$$

where c is the marginal (average) cost, assumed to be constant for simplicity.⁸ Maximization of equation (5) with respect to q gives the optimal quantity and profits as

$$q^t = \frac{(2 - c)q^*}{2} \quad (6)$$

and

$$\pi^t = \frac{(2 - c)^2 q^*}{4}.$$

Assume that marginal cost c has two components, c^p representing a constant marginal cost of production and c^t representing a constant marginal cost of transaction, such that $c = c^p + c^t$. The notion of transaction cost has been used in many different contexts in the literature. In our context, it refers to the sum of the cost of selling and monitoring the consumption of each unit, the cost of handling each type of consumer, and similar selling-related marketing costs. For the sake of simplicity, we assume that both c^p and c^t are constant.

Comparison between Two-Part Tariff and Buffet Pricing

If $c^t = 0$, clearly buffet pricing can never be more profitable than a two-part tariff. Similarly, if $c^p = 0$, buffet pricing is always more profitable than a two-part tariff. However, when both c^t and c^p are positive, buffet pricing and a two-part tariff become competing strategies. There is a trade-off between additional production cost and the savings in the transaction cost. Buffet pricing is more profitable than a two-part tariff if and only if

$$\pi^b = q^* - c^p q^* > \pi^t = \frac{(2 - c)^2 q^*}{4}. \quad (7)$$

Note that for positive profits under buffet pricing, $c^p < 1$.⁹ No such restriction applies to two-part tariffs. The intuition behind this restriction is straightforward: under a two-part tariff, the usage fee covers both

8. Oi (1971) provides the classic formulation of this pricing scheme. Varian (1989) formulates the problem in a more general setting. For a detailed analysis of two-part tariffs, see Schmalensee (1981). For different variations of two-part tariffs, see Tirole (1988).

9. In fact, the general condition for any linear demand is $c^p < a/2$. The production cost component must be lower than half the price intercept. In our specification, the price-intercept is two.

the production and the transaction cost; hence the entry fee guarantees positive profits. After simplification, inequality (7) can be written as

$$\frac{c^t}{c} > \frac{c}{4} = \frac{q^* - q^t}{2q^*} \quad (8)$$

or

$$(c^t + c^p)q^t > q^*(c^p - c^t).$$

The inequality $c^t \geq c^p$ is a sufficient condition for buffet pricing to be more profitable. When $c^t < c^p$, buffet pricing can still be more profitable, as stated below in Proposition 1. Note that $(c^t + c^p)q^t$ is the total cost under a two-part tariff. Under buffet pricing, c^p is the *actual* unit production cost and $c^t = 0$. The term $(c^p - c^t)$ can be considered as the net or effective unit cost under buffet pricing. We state the following proposition:

PROPOSITION 1. If the utility function is quadratic and the consumers are homogeneous, buffet pricing is more (less) profitable compared to a two-part tariff if the total cost under a two-part tariff is more (less) than the ‘net’ total cost under buffet pricing.

REMARK. The above proposition is in terms of costs only. The entry fees under the two pricing strategies do not play any direct role in determining profitability. Although the proposition is based on the specific form of the utility function, the result can be generalized in two ways. First, it is clear that for any demand function that is derived from a utility function with a satiation level of consumption, there exists a sufficiently low value of $c^p/(c^p + c^t)$ (share of production cost) such that for that low value of c^p , buffet pricing is more profitable than a two-part tariff. Second, it can be established that if the demand function is concave down (i.e., the demand function has a negative second derivative), any condition on costs and demand that is sufficient for buffet pricing to be more profitable under linear demand in the range between q^t and q^* is also sufficient for concave demand. In general, if the utility function is such that the marginal utility is concave down and decreases to zero, the resulting demand function is also concave down and buffet pricing is more profitable than under the same conditions as for linear demand.

IV. Heterogeneous Consumers

When consumers are heterogeneous, the total willingness to pay for each consumer is different. Thus, at any given entry fee ϵ , not all consumers will enter. Only those consumer types whose total utility is at least equal to the entry fee ($U(q_i^*) \geq \epsilon$) will enter. In addition to the

relative magnitudes of transaction and production cost, the proportion (distribution) of each consumer type becomes another significant determinant of the profitability of buffet pricing.

Consider a simple case in which there are only two types of consumers: low-demand (or low total willingness to pay) and high-demand (high willingness to pay). Let r and $(1 - r)$ be the proportions of the low-demand and the high-demand consumers, respectively. In order to serve the low-demand customers, the entry fee ϵ must be equal to their total willingness to pay. When the low-demand consumers are served, the high-demand customers will be served automatically because the entry fee they are willing to pay is higher than ϵ (if the buffet is attractive to light eaters, heavy eaters will certainly find it even more attractive). In order to see how the magnitude of r affects the trade-off, suppose r is relatively small. By including the low-demand consumers, the size of the market expands by the number of low-demand consumers.

However, this expansion has its cost. The cost of serving the high-demand consumers remains the same, but they now pay the lower entry fee ϵ . Hence, the seller suffers a “net loss” from the high-demand consumers and must decide whether or not to include the low-demand consumers. Buffet pricing can be more profitable only by serving both types if the additional revenue derived from the low-demand consumers can offset the net loss from the high-demand consumers. Intuitively, when the production cost is negligible compared with the transaction cost and r is relatively large, then the increase in the revenue from the low-demand consumers may offset the net loss from the high-demand consumers. This simple intuition is formalized below.

Assume that the utility-maximizing consumption for low- and high-demand consumers is q_L^* and q_H^* , respectively. Further, for comparison's sake, let $q_L^* = 1$ and $q_H^* = 2$. Let π^b and π_H^b denote the profits under buffet pricing when both types and only high-demand customers are served. It can be shown that

$$\pi^b \geq \pi_H^b \quad \text{if } r \geq \frac{1}{2 - c^p} \quad (9)$$

(see the appendix). The above inequality essentially states that for any given level of production cost, there is a critical value of the proportion r that determines whether or not both types can be served profitably. For example, if the production cost is zero and high-demand customers consume twice as much, the profits by serving only high-demand customers and both types are the same if the proportion of the two types is also the same ($r = .5$). However, even when both types are served profitably, buffet pricing may not necessarily be more profitable than a two-part tariff, as the comparison below shows.

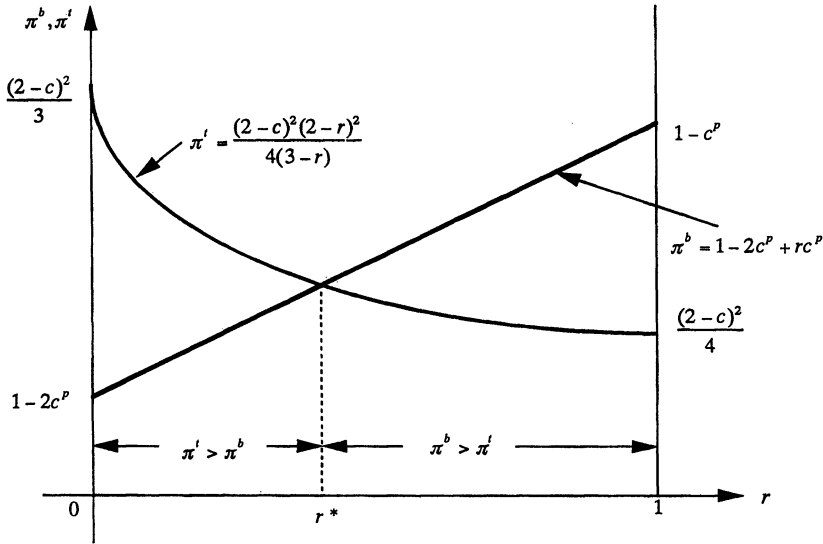


FIG. 1.—Profits under two-part and buffet pricing

Comparison between Two-Part and Buffet Pricing

When both types of consumers are served, profits under buffet pricing and two-part tariff can be given respectively as

$$\pi^b = 1 - 2c^p + rc^p \tag{10}$$

and

$$\pi^i = \frac{(2 - c)^2(2 - r)^2}{4(3 - r)}$$

(see the appendix). From equation (10), it is clear that π^b is an increasing linear function of r in the range $0 \leq r \leq 1$, with a maximum value of $1 - c^p$ at $r = 1$ and a minimum value of $1 - 2c^p$ at $r = 0$. It can be verified that π^i is a decreasing function of r in the same range with a minimum value of $(2 - c)^2/4$ at $r = 1$ and a maximum value of $(2 - c)^2/3$ at $r = 0$. Further, the second derivative is positive. Figure 1 shows the two profit functions. We compare the following three situations:

CASE 1. $1 - c^p < (2 - c)^2/4$.

This condition is equivalent to $c^i/c = c/4$. Figure 1 shows that π^i lies above π^b for the entire range of r . Hence, in this case buffet pricing can never be more profitable than a two-part tariff. In general, if the upper bound of the transaction cost share is small, a two-part tariff is

more profitable. This could be one reason why cable companies provide pay-per-view movies in addition to basic membership services. Greens fees charged at members-only golf clubs is another example.

CASE 2. $1 - 2c^p > (2 - c)^2/3$.

Again, from figure 1 it is clear that for this case π^b lies above π^t for the entire range of r . Hence, in this case buffet pricing is always more profitable compared to a two-part tariff. Simple algebraic manipulations reveal that this case implies $c^t > c^p$. If the lower bound of the transaction cost share is at least one-half, buffet pricing is more profitable. This explains why museums and monuments charge only an entry fee.

CASE 3. $1 - c^p > (2 - c)^2/4$.

Figure 1 shows that π^t is a decreasing function of r and π^b is an increasing function of r . Since at $r = 1$, $\pi^t < \pi^b$, and at $r = 0$, $\pi^t > \pi^b$, they must intersect at some $r = r^*$. Further, because $d^2\pi^t/dr^2 > 0$ such r^* is unique. Thus, when there are two types of consumers, there exists a unique r^* such that for $r < r^* < 1$, a two-part tariff is more profitable and for $r^* < r \leq 1$, buffet pricing is more profitable. For other ranges of the share of the transaction cost and proportions of low-demand consumers, either pricing strategy can be more profitable than the other. For example, in the health care industry some HMOs serve customers with a fixed fee and do not require any copayments. In the same industry, some insurance companies provide services that require copayments in addition to fixed premiums.

In the case of Disneyland, it can be argued that not only is the transaction cost of selling each ride separately to each visitor positive, but it also exceeds the production cost. Once the different rides are in place, their production cost is negligible. Many different types of consumers visit Disneyland. If we classify visitors as low- and high-demand consumers (e.g., adults and children, respectively) and note that Disneyland attracts a large number of foreign tourists and adults without children, the proportion of low-demand consumers is likely to be higher than the proportion of high-demand consumers. Hence, buffet pricing is more profitable because it serves both types as it expands the market size. Further, because the transaction cost exceeds the production cost, switching from a two-part tariff to buffet pricing is more profitable (case 2).¹⁰

10. In buffet pricing, each consumer self-selects rides, thus its use can minimize the queuing problem. If there is a long line for a particular ride, some consumers may switch to another ride. This switching possibility not only makes capacity utilization for Disneyland more uniform but also allows some consumers to take some rides they may not have taken if each ride were to be priced separately.

V. Conclusions

When the potential size of the market is large, the use of buffet pricing can result in significant savings in transaction cost to compensate for the additional production cost. When transaction cost is a significant component of the total cost, buffet pricing becomes a more profitable alternative to a two-part tariff. Clearly, such is the case for museums and monuments, and for both of them, buffet pricing is almost universal. A fixed entrance fee allows unlimited gazing at the beauty of the Mona Lisa or the Taj Mahal. In general, a fixed investment that reduces future variable production costs favors buffet pricing, but if it reduces future transaction cost, a two-part tariff or multipart tariff becomes more profitable.

Because a consumer reaches satiation when the time period for consumption is limited, buffet pricing can be used for both homogeneous and heterogeneous consumers and for both narrowly and broadly defined products. Casual observations confirm that, whenever buffet pricing is used profitably, the time period for consumption is restricted.¹¹ The time period may vary from a few hours for a buffet lunch to the duration of a subway trip, or to the daily operating hours of a museum.

There is a rich literature on patent licensing. There are many factors that determine the choice between a fixed fee and a royalty. Although all three pricing mechanisms have been modeled formally as rent-seeking devices, to the best of our knowledge, no formal analysis exists that explicitly considers a trade-off similar to the one considered in this article. The transaction cost of licensing a patent has not been formally considered as a decision variable. Most analyses assume the cost of licensing (the transaction cost) to be zero. When a patented technology reduces the production cost of the final good significantly and buffet pricing is feasible in the final good market, the reduction in production cost may provide an incentive to switch to buffet pricing in the final-good market. But, unless we know the relationship between the final demand and the derived demand, it cannot be determined whether the licensor is more likely to charge a fixed fee, a royalty, or both. Although our analysis cannot be extended easily to patent licensing, it suggests that the savings in transaction cost is another factor in choosing a pricing strategy for licensing a patented innovation.

11. Recently, the use of this form of pricing by America Online (AOL) was the focus of attention in the popular press. See, e.g., the *Economist* (March 8, 1997), p. 75. AOL has no enforceable way to limit the duration of time a consumer can stay connected. Since in many cases the telephone line charge is zero, those who were able to connect had no reason to disconnect, and these users made it difficult for new users to enter. An automatic disconnection after a certain time period of no activity by a user could have made the experiment successful. In many universities, the system disconnects the user after a certain period of no activity. The important prerequisite of buffet pricing (that the consumption must end after the restricted time period) was not met in the case of AOL.

Appendix

For comparison's sake, let the consumption corresponding to maximum total utility for the two types be $q_L^* = 1$ and $q_H^* = 2$. The profits when both types are served (π^b) and only high-demand consumers are served (π_H^b) can be written as

$$\pi^b = \epsilon - rc^p - 2c^p(1 - r) = \epsilon - 2c^p + rc^p$$

(A1)

and

$$\pi_H^b = (\epsilon_H - 2c^p)(1 - r),$$

where ϵ_H denotes the entry fee when only high-demand customers are served. For the utility function specified earlier, and for $q_L^* = 1$ and $q_H^* = 2$, it is easy to see that $\epsilon = 1$ and $\epsilon_H = 2$. Comparison of π^b and π_H^b from equation (A1) shows that

$$\pi^b \geq \pi_H^b \quad \text{if } r \geq \frac{1}{2 - c^p}.$$

Q.E.D.

Assuming that $q_L^* = 1$ and $q_H^* = 2$, the inverse demand functions for the two types can be written as

$$P = 2 - 2q_L$$

and

$$P = 2 - q_H.$$

When both consumers are served, the optimal entry fee equals the consumer surplus of the low-demand consumers. The profits, π^t , can be written as

$$\pi^t = \frac{(2 - P)^2}{4} + r \frac{(P - c)(2 - P)}{2} + (1 - r)(P - c)(2 - P). \quad (A2)$$

Maximization of equation (A2) with respect to P yields the optimal usage fee, P^* as

$$P^* = \frac{2 + 2c - r(2 + c)}{3 - 2r}. \quad (A3)$$

The total profits can be obtained by substituting for P^* in equation (A2), and after simplification we get

$$\pi^t = \frac{(2 - c)^2(2 - r)^2}{4(3 - 2r)}. \quad (A4)$$

References

Oi, W. Y. 1971. A Disneyland dilemma: Two-part tariffs for a Mickey Mouse monopoly. *Quarterly Journal of Economics* 85:77-96.
 Philips, L. 1983. *The Economics of Price Discrimination*. Cambridge: Cambridge University Press.

- Schmalensee, R. 1981. Monopolistic two-part pricing arrangements. *Bell Journal of Economics* 12:445–66.
- Tirole, J. 1988. *The Theory of Industrial Organization*. Cambridge, Mass.: MIT Press.
- Varian, H. R. 1989. Price discrimination. In R. Schmalensee and R. Willig (eds.), *Handbook of Industrial Organization*. Amsterdam: Elsevier Science.
- Wilson, R. 1993. *Nonlinear Pricing*. New York: Oxford University Press.