Journal of Industrial Organization Education

Manuscript 1035

Why Don't You Two Get a Room? A Puzzle and Pricing Model of Extra Services in Hotels

Damian S. Damianov, *University of Texas - Pan American*
Shane D. Sanders, *Western Illinois University*

DOI: 10.1515/1935-5041.1035

Why Don't You Two Get a Room? A Puzzle and Pricing Model of Extra Services in Hotels

Damian S. Damianov and Shane D. Sanders

Abstract

This case study focuses on the following "rational riddle" raised in a recent popular economics book: Hotels in Britain usually charge per guest while hotels in the US typically charge per room. What is the reason for this difference? We propose a pricing model for extra services which points to one possible explanation.

KEYWORDS: marginal pricing, price discrimination, self-disclosure of customer type

Author Notes: We would like to thank Editor James Dearden for valuable suggestions toward the improvement of the study.

Introduction

In *The Armchair Economist: Economics and Everyday Life*, a popular economics book, Steven Landsburg presents the following "rational riddle": "When two people share a hotel room in Britain, they often pay twice the single-room rate; in the United States they usually pay much less than that. What accounts for the difference? A non-economist might be satisfied with an answer based on tradition. The economist wants to know why this pricing structure is rational and profit-maximizing. If any reader has a suggestion, I'd be pleased to hear it." (pp. 17-18).

Landsburg leaves this question unanswered, and the purpose of this teaching case is to show how an economist might pursue an answer to this "rational riddle." In the following pages, we illustrate how a plausible explanation of this phenomenon can be constructed by using one of the economists' favorite tool—the simple monopoly pricing model.

In our model, the main factor that accounts for the difference in the pricing policies is the "number of cheaters." Underreporting the number of guests is presumably much easier and much more likely in large hotels with many guests than in small bed and breakfast inns. In his book (*North America* 1862), Englishman Anthony Trollope observes, "Hotels in America are very much larger and more numerous than in other countries" (555). Though almost 150 years have passed since Trollope's observation, small bed and breakfast inns (i.e., hotels run from a home or home-styled structure) have a markedly higher market concentration in the present-day United Kingdom than in the present-day United States. In the United Kingdom, bed and breakfast inns generated revenues of approximately $3.2 billion in 2009 within a tourism industry that generated approximately $137 billion in the same year (Bed and Breakfast Association, 2010). That is, bed and breakfast inns generated approximately 2.3 percent of United Kingdom tourism revenues in 2009. In the United States, bed and breakfast inns generated revenues of approximately $1.04 billion in 2007 within a tourism industry that generated approximately $767 billion in the same year (U.S. Census, 2007). That is, bed and breakfast inns generated only 0.14 percent of United States tourism revenues in 2007. Though hotel industry data are not uniform enough for us to conduct a full comparison of hotel types, this comparison offers some evidence that small inn-type hotels are more concentrated in the United Kingdom than in the United States. In the absence of general data on the topic, it is plausible to further assume that British hotels are on average smaller than their American countertype. Given this supposition, in the following model we will assume that it is more costly to maintain a stowaway at the typical

British hotel than at a typical hotel in the US. We show that, as a consequence, British hotels find it optimal to charge a higher second guest price.[1]

The Model

a. Preliminaries

We consider the pricing decision of a hotel serving guests who travel either alone or in pairs. The utility of a single-occupancy guest is given by

$$U_1 = \begin{cases} r - p_1 & \textit{if the guest stays in the hotel} \\ 0 & \textit{otherwise,} \end{cases}$$

where r is the reservation price of the consumer and p_1 is the price of single occupancy. The expected utility of consumers who travel in pairs is given by

$$U_2 = \begin{cases} 2r - p_1 - p_2 & \textit{if the second guest is reported} \\ 2r - p_1 - \tau p_2 - \tau\theta & \textit{if the second guest is not reported} \\ 0 & \textit{if the pair does not stay in the hotel,} \end{cases}$$

where p_2 is the added price of the second occupant, and τ is the probability that the second guest will be detected. If the unreported guest is detected, the couple will be required to pay p_2 for the extra guest, so the expected payment to the hotel equals τp_2. The last term, $\tau\theta$, captures the additional (inconvenience) cost for the couple of stowing away one of the guests, which is strictly increasing in the probability of detection. We further assume that θ is uniformly distributed on the interval $[0, \overline{\theta}]$, and $\overline{\theta}$ is the size of the double occupancy market. The size of the single-occupancy market is n_1. For simplicity we further assume that the hotel's marginal cost of renting a room is zero, and the room capacity of the hotel is non-binding.

b. The monopoly pricing problem

It is straightforward that the hotel will charge the reservation price $p_1 = r$ for the first guest. Given a price of p_2 for the second occupant, a couple will cheat if and only if

[1] It is important to note that the availability of substitute hotels also influences second guest pricing. If one took a British inn and transplanted it somewhere in the U.S., it is likely that the inn would charge a lower second guest price once transplanted. This prediction is based upon the existing availability of cheap substitutes for the second guest in the U.S. Thus, we might expect second guest price differences to hold across the two countries even for similar types of hotels.

$$2r - p_1 - p_2 > 2r - p_1 - \tau p_2 - \tau\theta \iff$$
$$\theta < \frac{1-\tau}{\tau} p_2.$$

Hence, the number of double-occupancy honest pairs is $\overline{\theta} - \frac{1-\tau}{\tau} p_2$ and the number of attempted-cheater pairs is $\frac{1-\tau}{\tau} p_2$. The profit of the hotel is thus

$$\pi(p_2) = \left(n_1 + \frac{1-\tau}{\tau} p_2\right) r + (\frac{1-\tau}{\tau} p_2)\tau p_2 + \left(\overline{\theta} - \frac{1-\tau}{\tau} p_2\right)(r + p_2).$$

The first term captures revenue from the single occupancy customers n_1 and the number of cheating couples $\frac{1-\tau}{\tau} p_2$ all of whom pay only the single occupancy price r. Eventually, a fraction τ of the cheating couples will be detected, and they will need to pay the hotel the extra guest price p_2. This additional revenue is represented by the second term, and the third term accounts for the revenue of the couples who honesty declare and pay the double occupancy charge of $r + p_2$. Rearranging terms we obtain

$$\pi(p_2) = -\frac{(1-\tau)^2}{\tau}(p_2)^2 + \overline{\theta} p_2 + (n_1 + \overline{\theta}) r.$$

The first order condition yields the following profit maximizing price:

$$p_2 = \frac{\overline{\theta}}{2} \cdot \frac{\tau}{(1-\tau)^2}$$

The optimal price is thus strictly increasing in the probability of detection, τ. Hence, the optimal price for the second guest is greater in England where the probability of detection is greater.

c. Cheating, second guest demand elasticity, and optimal pricing

Another approach for deriving the direct relationship between the probability of detection τ and the optimal price p_2 is through the elasticity of the demand for the second guest. Observe that, for a given price p_2, the number of pairs who will pay for the second guest is given by $D_2(p_2) = \left(\overline{\theta} - \frac{1-\tau}{\tau} p_2\right) + \tau \frac{1-\tau}{\tau} p_2$. The first term represents the number of pairs who reported the second guest truthfully, and the second term captures the number of cheating pairs who are detected. The elasticity of demand is given by

$$\epsilon = \frac{D_2'(p_2) \cdot p_2}{D_2(p_2)} = \frac{-\frac{(1-\tau)^2}{\tau} p_2}{\overline{\theta} - \frac{1-\tau}{\tau} p_2 + (1-\tau) p_2}$$

As the marginal cost of a room is assumed to be zero, the profit maximizing price p_2 for the hotel is the price for which the hotel maximizes its revenue, i.e. the price for which the elasticity $\epsilon = -1$. Solving this equation for p_2 we obtain the optimal price

$$p_2 = \frac{\overline{\theta}}{2} \cdot \frac{\tau}{(1-\tau)^2}$$

Conclusion

The simple pricing model developed here offers a possible explanation to Landsburg's "rational riddle." The model illustrates how the optimal price for the second guest depends on the probability that "cheaters" (pairs that do not report the second guest) will be detected. When the probability for unregistered guests for being detected is greater, the demand for the second guest is less elastic, i.e. couples are more likely to report and pay for the second guest. The inverse elasticity rule of monopoly pricing tells us that when demand is more inelastic, the monopolist sets greater prices. Hence, the second guest prices in British inns are greater.

The resolution of the riddle thus lies in the characteristics of the establishment and the market structure of the industry in various regions. Empirical evidence suggests that the United Kingdom features a greater concentration of small "inn-style" hotels than does the United States. It is therefore reasonable to conclude that relatively high extra person charges in the United Kingdom result from relatively low rates of guest underreporting. We offer an example of optimal pricing as a homework exercise.

Homework problem

Assume that the reservation price of a guest is $r = \$80$*, the cost parameter* θ *is uniformly distributed over the interval [0,64], and unreported guests are detected with a probability of* $\tau = 20\%$*. Assume also that there are a total of 64 couples and 30 single-occupancy consumers.*

a) *Set up the profit maximization problem of the hotel and determine the optimal prices for the first and the second guest. How many couples report the second guest and how many couples cheat? How many cheating couples are detected? Calculate the total revenue of the hotel.*
b) *Determine the elasticity of demand for the second guest. Determine the optimal price of the second guest using the elasticity of demand.*

Answer:

a) $p_1 = \$80$, $p_2 = \$10$. Out of the 64 couples, 40 cheat and 24 report the second guest. Out of the 40 cheating couples, 8 are detected. Total revenue of the hotel is:

- 30 x \$80 = \$2,400 (single occupancy)
- 24 x (\$80 + \$10)= \$2,160 (honest couples)
- 10 x (\$80 + \$10)= \$900 (cheating couples who are caught pay for the second occupant)
- 32 x \$80 = \$2,560 (cheating couples who do not pay for the second occupant)

Total: \$8,020.

b) $D_2(p_2) = 64 - \frac{1-0.2}{0.2}p_2 + (1-0.2)p_2 = 64 - 3.2p_2$. $\epsilon = \frac{D_2'(p_2)\cdot p_2}{D_2(p_2)} = \frac{-3.2p_2}{64-3.2p_2}$,

$$\epsilon = -1 \Leftrightarrow -3.2p_2 = 64 - 3.2p_2 \Leftrightarrow p_2 = 10.$$

References

Landsburg, S. E. (1993). *The Armchair Economist: Economics and Everyday Life* (New York, The Free Press/Macmillan).

Trollope, A. (1862). *North America* (New York, Harper & Brothers Publishers)