Dynamic pricing strategies: Evidence from European hotels

Graziano Abrate [a,b,*], Giovanni Fraquelli [a,b,c,1], Giampaolo Viglia [a,d,2]

[a] University of Piemonte Orientale "A. Avogadro", Department of Management Studies (SIT), Via Perrone 18, 28100 Novara, Italy
[b] HERMES Research Center, Via Real Collegio 30, 10024 Moncalieri (TO), Italy
[c] Ceris-CNR, Via Real Collegio 30, 10024 Moncalieri (TO), Italy
[d] University of Torino, Department of Statistics and Applied Mathematics, Corso Unione Sovietica 218 bis, 10134 Torino (TO), Italy

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ABSTRACT

How much do hoteliers actually make use of dynamic pricing strategies? We collected data on the price of a single room booked in advance (from three months to a single day), from almost 1000 hotels in eight European capital cities. Pricing strategies were analyzed by means of descriptive statistics, box plots and econometric panel data techniques. The empirical results show that the inter-temporal pricing structure primarily depends on the type of customer, the star rating and the number of suppliers with available rooms.

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1. Introduction

The nature of hotel rooms as a perishable asset is prompting hoteliers to maximize their revenue by trying to achieve optimal dynamic prices using different strategies. Conversely, customers can strategically change their purchase plans in order to pay as little as possible. In this context, heterogeneity among hotels and customers plays a key role. The best form of inter-temporal pricing strategies depends on the composition of the customer population alongside factors such as customer valuations and patience, as highlighted by Su (2007). In particular, if *high-valuation customers* have a proportionally lower degree of patience while *low-valuation customers* are often sufficiently patient to wait for sales, setting last-minute promotional low prices is preferable. Otherwise, strategic waiting by high-value customers would need to be discouraged by setting increasing price dynamics.

The rapid growth of the Internet has had a massive impact on the hotel industry; however, hospitality literature lacks published articles that examine the trend and the variability of prices in online markets (Tso and Law, 2005). Unlike those methods in decline (such as agency, fax and phone), the Internet encourages greater price scrutiny since the relevant information is both easier to obtain and transparent, given that any party can compare the prices of several alternatives with very little effort. This is bound to have an impact on how hotel operators set room prices since they too can easily obtain this information and rapidly respond accordingly.

This work aims to provide some evidence on the actual behavior of operators in the hotel industry. Do hoteliers really make use of dynamic pricing strategies? If yes, do we observe increasing or decreasing price trends when approaching the check-in date? From the customer perspective, how should they react to the seller's pricing strategies? What are the main drivers behind the price trend structure?

The empirical analysis is carried out on a sample of almost 1000 hotels distributed around different European capital cities. The idea was to observe the evolution of prices on a predefined booking day in order to verify the extent of price variability and the significance of any trend. Moreover, we investigate the presence of alternative pricing policies in relation to different hotel characteristics, dynamic competition in the overall booking period and potential customers. With respect to the latter, we collected data for different types of booking days, in particular, an intraweek day – Tuesday night – which is usually characterized by business travelers, as confirmed by the manager of an important international chain, and a weekend day – Saturday night – more in line with a leisure trip.

The remainder of this paper is organized as follows. Section 2 provides the literature review. Section 3 describes the conceptual framework, defining the hypothesis that will be tested in the empirical analysis. Section 4 starts by clarifying the sources of data (Section 4.1), thereafter presenting both descriptive data analysis (Section 4.2) and a more structured empirical model based on panel data econometric techniques (Section 4.3). Results of the panel data analysis are shown in Section 4.4. Section 5 provides a comprehen-

* Corresponding author. Tel.: +39 0321 375440; fax: +39 0321 375405.
  E-mail addresses: graziano.abrate@eco.unipmn.it (G. Abrate),
g.fraquelli@ceris.cnr.it (G. Fraquelli), viglia@econ.unito.it (G. Viglia).
  [1] Tel.: +39 011 6705250.
  [2] Tel.: +39 0321 375468.

sive discussion of the conceptual hypotheses in light of the results obtained. Finally, Section 6 offers concluding remarks and directions for future research.

2. Literature review

We analyze both theoretical and empirical contributions in literature concerning revenue management in hotels and other service industries characterized by finite inventories (such as, for example, airline seats).

From the theoretical standpoint, Gallego and Ryzin (1994), starting from a general demand function, proved that in some situations it is possible to estimate the exact optimal policy as a function of the room stock and the length of the time horizon. Ladany (1996), under the assumption of an aggregate non-linear demand function, offered an optimal market strategic segmentation pricing strategy by dividing the market into *n* segments to maximize profit. The segmentation is confirmed in this field by other authors and proved by more recent analyses. Badinelli (2000) discussed a model appropriate for small hotels to determine the optimal solution based on the number of vacancies and also on time and revealed/hidden market prices. A serious problem and limitation in applied analysis is that hotels tend not to release any data on vacancies. Zhao and Zheng (2000) describe the relation between price and time as a non-homogeneous Poisson process. As a result, if the willingness of a customer to pay a premium for the product does not increase over time, the optimal price decreases over time for a given inventory level, as in the fashion retail market. However, in the hospitality field, the customer accepts paying a premium price. Moreover, Su (2007) takes into account that the customer population is heterogeneous along two dimensions: they attribute different values to the product and have different degrees of patience. This is a crucial turning point in literature: his theoretical model delineates that "when high-value customers are proportionally less patient, markdown pricing policies are effective because high-value customers would still buy early at a high price while low-value customers are willing to wait." To the contrary, "when high-value customers are more patient than low-value customers, prices should increase over time in order to discourage inefficient waiting." To precisely understand the variables that underpin price, Qu et al. (2002) offer a simultaneous equations model suggesting that "hotel room price level" and "tourist arrivals" are significant factors driving demand for hotel rooms. Equally important, "hotel room quantity demanded", "room occupancy rate", "last period's room price", and "labor cost" significantly concur to form the final price. Another relevant aspect of this issue is that dynamic pricing strategies depend on competition between hotels. Martinez-de-Albéniz and Talluri (2011) demonstrate that hotels with few rooms tend to sell their rooms more frequently at a discounted price, whereas large hotels are less likely to sell all their rooms, but tend to charge the full price.

Empirical studies on price dynamics mostly concern airline markets. In a time series of 650,000 flights for which up to 13 fares were available, Piga and Bachis (2006a,b) identified through descriptive statistics that fares do not increase monotonically and moreover observed a higher volatility of fares in the four weeks preceding the departure date. Noone and Mattila (2008) focused their analysis on the effect of hotel price presentation on websites and demonstrated, with the ANOVA technique in a sample of 107 people, that the more clearly the price is identified on the hotel's website, the more the customer is inclined to buy. They also highlighted a customer tendency to prefer decreasing rates during the period booked, even if the total amount to pay is the same, and this "bizarre" result needs further investigation.

Analyses of the hotel industry are more concerned with the booking method and other price discrimination strategies, not necessarily linked to variability over time. This set of papers refers to the difference in booking the same service from different countries, channels or websites. Yelkur and DaCosta (2001) and Chung and Law (2003) studied the performance of hotel websites according to information on facilities, customer contact, reservations, surrounding area, and management of websites. They demonstrated that the bigger the company or the quality (in terms of star rating), the better the website in terms of information and effectiveness. Tso and Law (2005) found a significant difference in the amount of money one has to spend to obtain the same service from different distribution channels, local travel agents (traditional channels) vs. website or different countries (UK vs. Europe). This result is coherent with that obtained in the airline market by Brunger (2010), who demonstrated that in the same market those who book through traditional agencies pay more. This is the so called *internet price* effect. Ellison and Fisher (2005) argued that only one market place, for instance only one website selling a product, allows higher earnings either for the customer or for the company, as in the case of eBay.

3. The conceptual framework

Critical discussions from previous studies give evidence of theoretical models concerning the process of adjusting prices dynamically in the context of limited capacity. Empirical studies on price dynamics prevalently concern the airline industry, while there is a lack of empirical evidence in the context of hotels. In this section we build a number of theoretical hypotheses that will be verified through an empirical analysis, related to the presence in the hotel industry of an *online* dynamic pricing policy and a price discrimination strategy among heterogeneous customers.

First, the hotel industry is an ideal field of application for the theory of revenue management (as a general reference, we can refer to Talluri and Van Ryzin, 2004). Usual price differentiation criteria are the physical attributes concerning service provision (facilities and amenities), reputation (star classification and brand affiliation), site-specific attributes (location, local attractions, climate, and beach). At the same time, the growth of the Internet has increased the hotels' opportunities to discriminate clients, applying different prices on the online market over time (Tso and Law, 2005; Kannan and Kopalle, 2001). However, this opportunity may be seized differently across hoteliers, and there are no studies yet that quantify the diffusion of dynamic pricing in practice. Moreover, the theoretical solution to the revenue management problem faced by each hotel can be affected by several factors such as the number of rooms that can be sold as well as their qualitative positioning on the market.

Hypothesis 1 (*H1*). *Hoteliers make use of online dynamic pricing strategies. The extent of the inter-temporal price variability depends on hotel characteristics such as star category and size.*

In the preceding literature review we discussed Su's (2007) model. He develops a model where the seller adjusts prices dynamically in order to maximize revenue, demonstrating that customer composition and behavior are the main drivers of the optimal pricing strategies. The prices should decrease over time when high-valuation customers are quite impatient "to buy early at higher prices" and low-valuation customers are "sufficiently patient to wait for sales". When waiting costs are high, customers will not wait to buy; when waiting costs are low customers will delay their purchases in order to benefit from promotions and discounts. On the other side, prices should increase over time when "high-valuation customers are more patient than low-valuation customers: this discourages inefficient waiting and also captures surplus from high-valuation customers who miss the promotional prices".