

## The exploration of hotel reference prices under dynamic pricing scenarios and different forms of competition

### ABSTRACT

The reference price, used by consumers to evaluate market prices, has tremendous relevance in dynamic pricing. Reconciling current heterogeneous theories and studies on reference prices, this paper analyzes the impact of hotel price sequences on consumers' reference prices through a lab and a field experiment. Experiment 1 tests the importance of retrospective price evaluations, while Experiment 2 evaluates the impact of three forms of competition: (i) simultaneous behavior, where firms adjust prices simultaneously; (ii) leader-follower behavior, where one firm acts as the leader; and (iii) independent behavior, where each player takes its rival's strategy as given and seeks to maximize its own profits. The results show that consumers decrease their reference price when competing hotels adjust their prices simultaneously. Relevant managerial implications are drawn for the hospitality industry, which is affected by the presence of online travel agencies that announce the daily rates offered by each competitor.

**Keywords:** *reference price; dynamic pricing; hotel pricing; price competition; price comparison*

## **1. Introduction**

Suppose that Carol wants to book a hotel room and begins checking prices (hotel rates) over the Internet. After several searches, she realizes that there is a certain degree of price variability each time she checks. To judge the prices she is offered, she can recall the prices she may have seen in the past, the prices paid for rooms at the same hotel, and/or the prices charged by similar competing hotels. What she has seen or paid in the past, along with the prices of comparable hotels, will influence her price evaluation.

The issue of customers' price evaluations—how customers perceive prices and their variations—has become an important topic in hospitality management, particularly due to the widespread adoption of revenue management techniques by the lodging and travel industry. Dynamic pricing practices are now common and have become more feasible as Internet purchasing behavior has increased (Abrate et al., 2012). The widespread use of dynamic pricing is partly attributable to online tools, by which hotels can easily adjust prices in real time depending on the number of available rooms, the inventory and prices of close competitors, and other contextual indicators. However, though these pricing practices may benefit both sellers and buyers, consumers may perceive dynamic pricing as unfair because it produces a variety of rates for what appear to be identical products, such as the same hotel room (Choi and Mattila, 2005).

The reference price is the standard against which consumers evaluate current product prices to assess their attractiveness (Monroe, 1973). Reference price has been the subject of a large body of research by both economists and marketing scholars. It can be conceptualized as a price expectation based on customers' memories of previous information (Mazumdar et al., 2005) or

as the normative price—the price considered a “fair” charge for the product (Bolton et al., 2003; Campbell, 1999).

Several studies have underlined the importance of including customers’ reference price in price response models (Lichtenstein and Bearden 1989; Rajendran and Tellis, 1994). Moon, Russell and Duvvuri (2006), investigating how consumers encode prices, define three types of price response: i) comparing current prices to some function of observed past prices, i.e. memory-based reference price, ii) considering only the current distribution of prices, i.e. stimulus-based reference price and iii) considering just the observed price, i.e. not accounting for any source of reference price. An empirical analysis in their study shows that consumers using at least one sort of reference price are predominant. In both the reference conditions, memory-based reference price and stimulus-based reference price, consumers weight price losses much more than price gains. This finding is consistent with the ideas that a reduced price has a strong effect on the reference price (Bambauer-Sachse and Massera, 2015) and that price losses loom larger than gains (Erdem et al., 2001).

This study overrides the static determinations of the reference price, including (for the first time in a field study) the impact of competitors’ prices on the determination of the reference price. This paper reconciles the relevant literature and then discusses the formation of the reference price based on sequences of past prices (i.e., the temporal dimension) and the theoretical foundations of the interrelated mechanisms between the reference price and the competition (i.e., the contextual dimension). Lab and field experiments are used to analyze the importance of each piece of past information in the formation of the reference price, not only from a static perspective but also by observing how the presence of different types of

competition (i.e., simultaneous, leader–follower, and independent competitors) shapes the reference price. This paper thus explores both the internal and external dimensions of reference prices. Finally, several managerial implications for the international hospitality industry are drawn.

This article applies experimental methods used in behavioral economics, as in Lee and Jang (2013b), to examine the above questions, so that external influencing factors (such as the impact of hotel location) are eliminated. The experimental economic methodology for dealing with consumer research questions was initially advocated by Ariely and Norton (2007) in cases where abstractions had to be used to capture the essential elements of the investigated phenomenon. More recently, Nicolau and Sellers (2012), uncovering the relation between willingness to pay and product bundling in hospitality, suggested that the link between experimental economics and tourism should be reinforced to detect nonrational economic behavior.

## **2. Theory**

As observed by Rajendran and Tellis (1994), despite its intuitive appeal, reference price began to be formally modeled only in the late 1980s. The concept of reference price has been conceptualized through multiple theoretical approaches, leading to many different operationalizations of the reference price construct (Rajendran and Tellis, 1994; Briesch et al., 1997). To disentangle these various perspectives on the topic, a number of comprehensive literature reviews have attempted to integrate them. Mazumdar et al. (2005) present a review of published articles on reference price, dealing with i) the formation of reference price, ii) the retrieval and use of reference price, and iii) the influence of reference price on various purchase decisions and evaluations. Kalyanaram and Winer (1995) developed three empirical

generalizations based on the research on reference price, observing that reference prices have a significant impact on consumer behavior concerning the evaluation of past prices, sensitivity to price losses, and purchase and brand decisions.

Particularly relevant to our study is the contribution of Rajendran and Tellis (1994), who explore the temporal and contextual components of reference prices. They define the temporal dimension as the internal reference price—the prices faced by consumers on past purchase occasions and stored in their memory. The contextual component includes the different prices of products within the same product category (Mazumdar and Papatla, 1995). This formulation of reference price, based on the current price of some contextual good or service, is denoted the “external reference price” (Hardie et al., 1993; van Oest, 2013). It is important to note, however, that some empirical evidence suggests that these two mechanisms operate simultaneously and should be assessed jointly (Mazumdar and Papatla, 2000).

The idea that individuals make judgments and choices based on reference prices can shed light on the tourism and hospitality relationship between prices and consumers’ response (Nicolau, 2011). The reference price concept in its multiple formulations becomes particularly relevant in contexts where favorable conditions for dynamic pricing occur, as the importance of reference price increases with price instability (Winer, 1986). In sectors highly characterized by dynamic pricing scenarios (e.g., the airline, hospitality, and retail industries), consumers can frequently pay a different price for the same good or service, increasing the potential for perceptions of unfairness with respect to past purchases and contextual cues (Xia et al., 2004; Karande and Magnini, 2011). Thus, along with the implementation of dynamic pricing, the

reference price should be an essential component of managerial decisions concerning pricing, promotional strategies, and tactics.

### *2.1. The temporal component: Reference prices and sequences of historical prices*

A key aspect of reference prices is the effect past price sequences may have on their determination. Although several studies suggest that time-based pricing strategies tend to be accepted by consumers, price discrimination may be perceived as unfair if standard conventions are violated (Huang et al., 2005; Wirtz and Kimes, 2007). Recent studies have thus assessed optimal dynamic pricing strategies with reference effects (Puppe and Rosenkranz, 2011). Surprisingly, perceptions of unfairness tend to remain stable across levels of brand class or segment, varying only across levels of familiarity with dynamic pricing strategies (Taylor and Kimes, 2011).

Purchasing decisions have a temporal dimension; individuals usually form their reference prices after having observed sequences of prices (Lattin and Bucklin, 1989; Kalyanaram and Winer, 1995; Bell and Lattin, 2000) while collecting the available information (Thaler, 1985). As the hospitality industry is widely adopting dynamic pricing and revenue management techniques, the factors characterizing the formation and updating of reference prices must be investigated. What are the most important factors in a price sequence? Building on the literature, this article identifies two factors in the sequences of past prices that can affect the current reference price: the first, average, and last price seen, and the highest and the lowest price.

*First, average, and last price.* Dickson and Sawyer (1990) conducted a field study and found that the further in the past a price was, the less it contributed to the current reference price.

Reference prices are often represented as a decaying weighted average of all past prices (Jacobson and Obermiller, 1990). The last (i.e., most recent) price is assumed to be the most influential, as in Nasiry and Popescu (2011). Contrary to these findings, however, Baucells et al. (2011) found in a financial setting that the first price was influential in the formation of reference prices; however, in their study, the first price was also the investor's purchasing price. Grant, Xie, and Soman (2010) focused on the trend of previous prices and showed that people updated reference prices asymmetrically: they adapted their reference prices more quickly to "good news" and more slowly to "bad news."

Based on this literature, we propose that recent price information is more important than older price information in the determination of the reference price. We further posit that consumers adapt more rapidly to good news (i.e., a price reduction) than to bad news (i.e., a price increase).

We thus derive the following hypotheses for the timeline factors:

**H1a.** The order of the previously available prices affects reference price formation, with more recent price information being more salient for consumers.

**H1b.** Upward and downward price fluctuations have different impacts, with the latter being more effective in affecting the reference price.

*Highest and lowest price.* Kahneman et al. (1993) introduced the magnitude of past peaks as part of the evaluation of a price sequence. The lowest price seems to be an important cue for reference prices (Viglia and Abrate, 2014), although high prices matter too, due to loss aversion (Novemsky and Kahneman, 2005). Cowley (2008) shows that people tend to evaluate past

experiences by performing a retrospective evaluation through “rose-colored” glasses, suggesting that *good news* (such as paying a low price) is given much more weight than other information. Dolansky and Vandebosch (2013) show that people are willing to accept vendors with higher expected future prices if their historical price sequences are perceived to be less variable. The effect of sequence directions on preferences is thus mediated by perceptions of variability, which may increase perceived risk.

Accordingly, magnitude price considerations are also expected to shape reference prices, which leads to the following hypothesis:

**H2.** Extreme past peaks (i.e., the lowest and highest available prices) reduce the reference price.

Knowing which prices matter more is relevant because hotel managers can incorporate these factors into their pricing strategies. The knowledge can also help educate consumers by making them more aware of the factors that drive their perceptions of “expensive” and “inexpensive.”

## *2.2. The contextual component: Reference prices and competition*

When hoteliers are unable to convince customers that their product is worth more than the competitors’ through factors beyond price, price replaces brand, service, and physical property as the key driver of purchase decisions.

The literature has extensively addressed how pricing perceptions and actions are driven by competition. Economists have long been describing competitive behaviors, mainly in terms of (non-cooperative) Nash behavior and (cooperative) leader–follower competition. Following



Caves (1984), researchers began to describe the complexity of competitive rivalry, moving down the levels of analysis to the basic building block of competition: the competitive action–response dyads.

Raju and Roy (1997) define three forms of competitive interaction: (i) simultaneous behavior, where firms adjust prices simultaneously; (ii) leader–follower behavior, where one firm acts as the leader (i.e., it does not react to its rival’s actions) while its rival follows changes in the leader’s strategic behavior; and (iii) independent behavior, where each player takes its rival’s strategy as given and acts to maximize its own profits.

Understanding price competition requires determining if and how firms respond to each other’s price decisions. Numerous empirical studies have established the existence of leader–follower interactions among competitors (Roy et al., 1994, Kadiyali et al., 1998), and recent research has begun to establish the conditions under which price leadership–followership occurs and those under which firms set their prices independently (Roy and Raju, 2011). Competition in the hospitality business has been observed to be intense due to the adoption of revenue management. Hotels typically define and adjust their prices by monitoring the rates applied within their so-called “competitive set.” This adjustment is often automatic. Rate shoppers and whole sellers track competitors’ room rates across all distribution channels, integrating revenue management systems (Mauri, 2012). This severe competition appears to be especially remarkable in agglomerations of large cities (Lee and Jang, 2012), with rapid price responses (Becerra et al., 2013) and implications for growth (Falk and Hagsten, 2015).

The role of competition in pricing leads us to a third hypothesis, concerning the link between reference price formation and competitors’ action-response dyads. This study explores

the influence on reference price formation when simultaneous patterns occur, when leader–follower behavior occurs, and when no action–response dyad is present (i.e., when two competing hotels act independently). Moon and Voss (2009) portrays that consumers incorporate not only the price suggested by the firm, but also the reference prices for the entire product category into their assessment of price fairness. Xia, Monroe, and Cox (2004) add that, when competitors adjust prices simultaneously, the consumer’s perception of unfairness increases. If this principle holds in the hospitality sector, it would imply that unfairness perceptions arise (and thus the reference price decreases) as a function of hotels’ responses to each other’s price decisions. We seek to experimentally validate this proposition. A study that manipulates the degree to which hotels respond to each other’s price decisions can be useful due to the increasing number of websites that show charts of competitors’ prices (Dreschsler and Natter, 2011) for certain types of products. These websites, such as NexTag.com, allow customers to increase the information available to them while evaluating prices, which carries implications for sales. We thus propose the following:

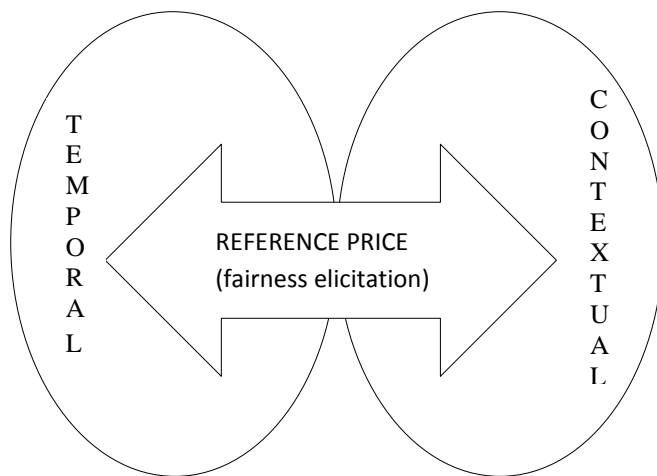
**H3.** The degree to which hotels respond to each other’s price decisions is an inverse function of the reference price.

Drawing on the findings of Lee and Jang (2013a), we consider situations in which hotels are not differentiated by quality because the outcome of simultaneous price adjustments would be asymmetric and not perceived as comparable by consumers. We also isolate other possible contextual factors such as the location of the hotel, which appears of paramount importance in terms of the attractiveness and density of the area (Rigall-I Torrent et al., 2011), and the impact

of social comparison, which was shown to have a tremendous effect on the reference price (Viglia and Abrate, 2014).

Integrating all the above, we can derive and sketch our conceptual model, which forms the cornerstone of our work. Figure 1 presents the two components, temporal and contextual, that impact the reference price.

**Figure 1. Conceptual Model**



Experiment 1 focuses on the temporal dimension, while Experiment 2 sheds light on the contextual dimension. Below, we describe the methodology used and explain why we operationalized the reference price as the fair price.

### **3. Method**

We use a lab experiment and field study to isolate the relevant factors and identify the causal relationships concerning the effect of pricing policies. These methodologies have often been used in hospitality research, particularly to measure the effect of monetary and pricing strategies (Lynn and Lynn, 2003; Liang, 2014).

Consider a consumer who observes a sequence of prices  $P_i$ ,  $i = 1, \dots, n$ . She observes one unit of a product in period 1 at price  $P_i$ , forming an initial reference price. In the subsequent periods, she observes other pieces of information, allowing her to update her reference price. Reference prices may be measured indirectly, by observing consumer choices. Such inferences are noisy, however, as they are affected by other factors.

Rajendran (2009) proposed an operationalization of the reference price that depended on whether it was conceptualized based on the notion of expected or fair price. While the expected reference price is elicited as the “estimate of the likely price,” the fair reference price is elicited as the “price above which it would be too high and below which it would be a good deal.” This article elicits reference prices within the fairness conceptualization because, as shown in Rajendran (2009), consumers are becoming increasingly concerned with fairness and good value when retrieving reference prices from past prices. Thus, this study’s subjects must state the price at which they would feel “neither happy nor unhappy about the purchase.” Baucells et al. (2011) and Arkes et al. (2008) adopt this approach by asking subjects about the price at which they would feel “neither happy nor unhappy about the purchase,” the premise being that a positive (negative) price comparison generates positive (negative) feelings.

#### **4. Experiment 1 (lab experiment)**

Experiment 1 measures the impact of the past price factors, in sequences, on the reference price (internal reference price). The sequences are designed to favor pair-to-pair comparisons. This experiment tests H1a, H1b, and H2.

#### *4.1. Subjects*

The subjects of the experiment were 60 undergraduate students enrolled in a course in Online Marketing at Pompeu Fabra University (Spain) who, after a pre-test on their familiarity and experience with purchasing online hospitality services, were invited to participate in the study through an e-mail invitation in the lab. The students' average age was 22, with a range from 21 to 28. Subjects received a fixed payment of €5 for their participation. Before receiving the financial reward, students were asked to indicate whether the instructions were clear on a scale from 1 ("completely unclear") to 5 ("completely clear"). The average score was 4.3, suggesting that the subjects understood the presented scenarios quite clearly. The average processing time was 30 minutes.

#### *4.2. Instructions and procedure*

The subjects were asked to observe sequences of prices charged by a single hotel with no other additional information given. They were presented with the following text: "You already checked the Internet for a three-star hotel and you found a different price offer each day. Only after observing the different prices—you have no other information—you ask yourself which price you think is neither expensive nor cheap for the booking." There was a four-second delay before each new price was added to the sequence, from the first price (on the left of the sequence) to the last price (on the right of the sequence). To reproduce a different number of previously recalled prices, we varied the length of each sequence of prices from between three and eight periods. The total number of sequences presented to the subjects was 24, and their order was randomized. The subjects monitored the sequences of prices; at the end of every sequence, they were asked to write the price they perceived as "neither expensive nor cheap."

The variability in the prices of the predesigned sequences was consistent with the use of dynamic pricing in the hoteling industry (Abrate et al., 2012). A screenshot of the experimental scenario is provided in the appendix.

#### *4.3. Design and factors*

Based on the framework above, this study proposes five within-subjects factors that can influence reference prices: the first price ( $P_1$ ), the last price ( $P_n$ ), the average price ( $\sum_{i=1, \dots, n} P_i / n$ ), the highest price ( $\max_{i=1, \dots, n} P_i$ ), and the lowest price ( $\min_{i=1, \dots, n} P_i$ ). The final design consists of 24 price sequences, creating 12 pairs, as shown in Table 1. Column  $P_i$  contains the  $i_{th}$  price of each sequence; price units are in euros. The two sequences in each pair are identical to each other with respect to all five factors but one. For example, sequences 1 and 2 share the same last price (100), the same average price (100), the same highest price (150), and the same lowest price (50), varying only in the first price, which is higher in sequence 1 (150 versus 50). Table 1 presents the 24 sequences, along with the average response and the standard deviations.

**Table 1. The 24 Price Sequences Used in Experiment 1**

<i>Factor investigated</i>	Seq. k	$P_1$	$P_2$	$P_3$	$P_4$	$P_5$	$P_6$	$P_7$	$P_8$	<b>Avg. <math>R_k</math></b>	<b>Sd <math>R_k</math></b>
First price	1	150	100	50	100					<b>109.2</b>	<b>20.4</b>
	2	50	100	150	100					<b>97.4</b>	<b>15.4</b>
	3	150	100	50	100	60	100	140	100	<b>120.6</b>	<b>16.9</b>
	4	50	100	150	100	140	100	60	100	<b>101.8</b>	<b>11.2</b>
Last price	5	100	50	100	150					<b>96.4</b>	<b>15.6</b>
	6	100	150	100	50					<b>85.7</b>	<b>15.1</b>
	7	100	50	70	100	150	130			<b>95.7</b>	<b>13.4</b>
	8	100	150	130	100	50	70			<b>85.7</b>	<b>12.8</b>
Average price	9	50	100	100						<b>82.7</b>	<b>11.0</b>
	10	50	50	100						<b>76.8</b>	<b>8.4</b>
	11	50	100	150	140	140	140	140	120	<b>122.8</b>	<b>10.6</b>
	12	50	100	150	100	100	100	100	120	<b>114.0</b>	<b>12.5</b>
Lowest price	13	150	100	100	100	100				<b>109.4</b>	<b>14.8</b>
	14	150	150	100	50	100				<b>106.3</b>	<b>17.1</b>
	15	150	130	100	100	100	100	100	100	<b>129.7</b>	<b>9.74</b>
	16	150	130	100	120	120	100	60	100	<b>122.8</b>	<b>13.3</b>
Highest price	17	50	50	100	150	100				<b>78.9</b>	<b>14.2</b>
	18	50	100	100	100	100				<b>101.5</b>	<b>11.6</b>
	19	100	50	100	60	100	140	100		<b>91.0</b>	<b>12.9</b>
	20	100	50	100	90	100	110	100		<b>101.7</b>	<b>12.8</b>
<i>Dashed hope vs. False alarm</i>	21	100	50	100						<b>89.6</b>	<b>13.6</b>
	22	100	150	100						<b>101.8</b>	<b>14.8</b>
<i>Early vs. Late</i>	23	100	50	100	150	100				<b>95.7</b>	<b>12.3</b>
	24	100	150	100	50	100				<b>103.6</b>	<b>11.9</b>

#### 4.4. Results

Table 2 presents the influence of each factor analyzed.

**Table 2. The Effect of the Different Factors**

	Our study		BWW Average
First price	1–2 0.12 (0.000)	3–4 0.19 (0.000)	<b>0.48</b>
Last price	5–6 0.11 (0.000)	7–8 0.17 (0.000)	<b>0.21</b>
Average (intermediate) prices	9–10 0.12 (0.000)	11–12 0.26 (0.000)	<b>0.09</b>
Low price	13–14 0.06 (0.098)	15–16 0.17 (0.000)	<b>0.06</b>
High price	17–18 -0.45 (0.000)	19–20 -0.36 (0.000)	<b>-0.09</b>

Each entry indicates the pair of sequences  $k$  of Table 1, the unit effect that a change in the row factor has on  $R_{k+1} - R_k$ , and the  $p$ -values of a  $t$ -test on the difference of the mean. The BWW Average column presents the results obtained by Baucells et al. 2011 in their experiment.

To interpret these values, consider the pair of sequences 1 and 2. The elicited reference prices are  $R_1 = 109.2$  and  $R_2 = 97.4$ . Dividing this difference by 100 (the difference between the two initial prices) shows how every unit increase in the first price affects the reference price.

The final column presents the results obtained in finance by Baucells et al. (2011), or BWW. This study compares low prices with their high prices because, from an investor’s perspective, a high price is a gain whereas, from a consumer’s perspective, a gain is the presence of a low price.

The analysis produces the following results for each group of factors:

- *First, average, and last price.* The first price creates a reference point for consumers that allow them to initially evaluate a service. BWW found a stronger effect because the first price was also the purchase price. For consumer prices, the influence of



the first price on the formation of reference prices is more moderate but more relevant than the last price. As for the average, recalling that, in the design of these pairs the first and last prices of the two sequences are the same, the pair comparison measures the effect of both the average price and the average of the intermediate prices  $\sum_{i=2}^{n-1} \frac{P_i}{n-2}$ . In the calculation of the unit price, this study uses the latter. The effect of the average price is a driver of the formation of reference points.

- *Lowest and highest price.* Recalling that the average is the same for every sequence, these two factors measure the effect of past peaks within a price sequence. This study finds that strong past peaks tend to reduce the reference price (see the sequence pairs 13–14, 15–16, 17–18, and 19–20 in Table 1). Our results show that the past peaks are even more relevant than in BWV.

To draw inferences about the effect of this trend, we examined an effect that can be labeled “hope vs. alarm.” We produced two series that started and ended at the same price level with a price increase followed by a decrease and a price decrease followed by an increase, respectively (see Table 1, sequences 21 and 22). In sequence 21, the initial price is 100, the intermediate price decreases to 50 (hope), and then reverts to the original price of 100. In sequence 22, the initial price is 100, the intermediate price increases to 150 (alarm), and then reverts to the original price of 100. The increases and decreases are of the same magnitude (50): in sequence 21 the reference price is 89.6, while in sequence 22 it is 101.8.

The difference in reference points is highly significant in the sequence pair studied ( $t(58) = 3.32, p < .05$  for the 21–22 pair). Following the same variation in the exposed prices ( $\pm 50$ ), we found that the sensitivity of the reference price is more intense when facing downward

fluctuations than when facing upward ones. In the “alarm” case, the reference price increases by only 1.8 on average against the baseline price (100), while, in the “hope” case, the reference price decreases by 10.4 on average. These results suggest that subjects are more prone to adapt to price reductions (the transient “good news” brought by hope) than to price increases (the transient “bad news” brought by alarm).

To better disentangle the analysis on the first vs. the last effect, we measured an effect that can be labeled “early vs. late price effect.” In sequence 23, the price drops and then rises, while in sequence 24, the price rises and then drops. The pair comparison yields a significant difference ( $t(58) = 2.25, p < .05$ ) in reference prices: people seem more influenced by early prices. The difference of 7.9 between average values in sequence 23 and 24 implies that early prices set a reference that is difficult to change.

#### *4.5. Discussion*

The results on the factors guiding reference prices are as follows. On the one hand, H1a receives partial support because the first price has a larger impact on the reference price, an effect further confirmed by the “early vs. late” sequences. The weight given to initial information appears to be greater than that given to recent information. On the other hand, H1b is fully supported: consumers are much more reactive to price decreases than price increases. The impact of magnitude factors (H2) is large, but it is asymmetrical and depends on a specific set of analyzed sequences. This study finds a strong negative effect on reference prices when a high price is present, which is further accentuated in the social case. Recalling that, by construction, the presence of a high price implies lower values for the remaining prices, a possible explanation

for this result is that consumers do not take the high outlier into account when forming the reference price.

## **5. Experiment 2 (field experiment)**

Experiment 2 investigates the joint effect of two competing hotels on the reference price. Measuring current prices for contextual goods allows a testing of the impact of the external reference price. The new contribution here concerns the impact of the competitive action–response dyads (H3). Experiment 2 also sought empirical validation of the results obtained in the lab (Experiment 1) for the lodging industry.

### *5.1. Subjects*

We conducted the field study at the five-star hotel Princesa Sofia in Barcelona (Spain) in August 2013 with real hotel clients under conditions of higher involvement than in the lab study. After a pre-test on clients' familiarity with and experience in purchasing online hospitality services, 104 random clients agreed to participate. The average age of the clients was 43, with a range of 23 to 71. The average processing time was 21 minutes. Five randomly selected participants received a 25-euro mobile phone voucher for their participation.

### *5.2. Instructions and procedure*

To measure the impact of competition on the reference price, clients were asked to observe sequences of prices that were actually charged for one night in a single room by the study hotel and by a close competitor (Eurostars Barcelona Design) on Booking.com. Aside from the competition part, which saw the addition of a new operator, the framing was exactly the same as in Experiment 1. Clients were presented with the following text: "You are observing the

prices of two competing hotels of a similar quality on a daily basis. One hotel presents prices that are an average of 20 euros higher than the other. Only after observing how the sequence of different prices evolved—you have no other information—you ask yourself which price you think is neither expensive nor cheap for an *average* booking.”

As in Experiment 1, there was a four-second delay before each new price (here, a pair of prices) was added to the sequence from the first price pair (on the left of the sequence) to the last price pair (on the right of the sequence). Each pair of sequences was five prices long; to preserve orthogonality, we kept the first and the last price of each pair constant, allowing us to isolate the impact of each factor. A total of six pairs were presented to the subjects; the order of their sequences was randomized. Although the prices shown are the prices that were actually charged by the two hotels for a night in a single room, with discounts in line with Nusair et al. (2010), we artificially designed the sequences in each pair to present the three treatments (i.e., possible forms of competitions): there were (i) two pairs of sequences where synchronized patterns occur, (ii) two pairs of sequences where leader–followers occur with a time lag, and (iii) two pairs of sequences with no action–response dyad. Because the subjects saw all the treatments, our design was *within-subjects*. Due to the slightly more complicated design (relative to Experiment 1), we presented prices graphically to allow participants to better see the price patterns between the two competing hotels. Additionally, for the sake of clarity, we rounded out the prices on Booking.com to keep the price comparison easy to present and understand graphically. As in Experiment 1, prices were presented on a computer screen. Table 3 summarizes the different price sequences, showing the average reference price stated, along with the related standard deviation for each pair. If in one manipulation the average reference price is seen as significantly

higher or lower than in another, the condition affected the movement of the reference price up or down.

**Table 3. Pairs of Sequences Used in Experiment 2**

<i>Treatment</i>	Seq. k	$P_1$	$P_2$	$P_3$	$P_4$	$P_5$	Customers' reference price	
							Average	St. dev.
Simultaneous	1	110	100	110	120	110	<b>93.13</b>	<b>6.16</b>
	2	90	80	90	100	90		
Simultaneous	3	110	120	110	100	110	<b>93.03</b>	<b>6.05</b>
	4	90	100	90	80	90		
Leader–follower with time lag	5	110	100	120	110	110	<b>94.13</b>	<b>6.74</b>
	6	90	90	80	100	90		
Leader–follower with time lag	7	110	120	100	110	110	<b>95.77</b>	<b>6.34</b>
	8	90	90	100	80	90		
Independent prices	9	110	120	100	110	110	<b>97.16</b>	<b>5.65</b>
	10	90	80	100	90	90		
Independent prices	11	110	110	100	120	110	<b>98.89</b>	<b>5.30</b>
	12	90	90	100	80	90		

**Prices in euros**

The graphical interface used for Experiment 2 is provided in the appendix.

Clients monitored the sequences of prices and, at the end of the sequence, were asked to select the price they perceived as “neither expensive nor cheap”, according the aforementioned method.

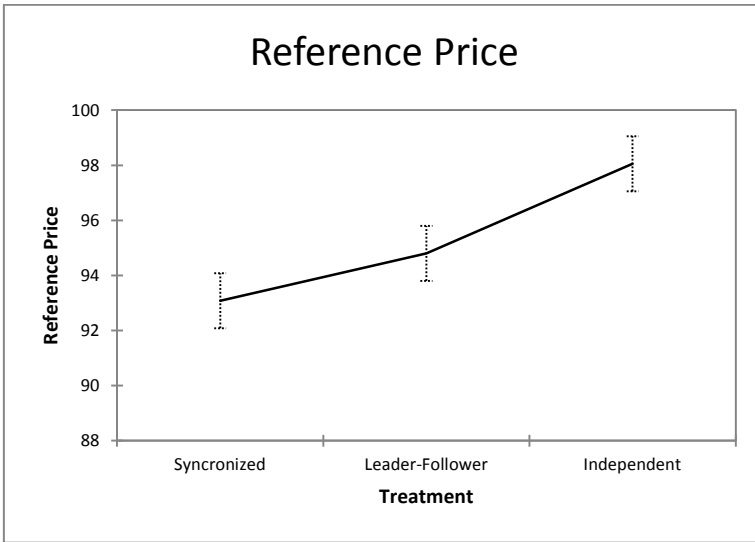
### 5.3. Results

The final two columns of Table 3 present the average value of the reference price and the standard deviation for each pair of sequences.

In all the sequence pairs, the average stated reference price is closer to the average price of the cheapest hotel (90) than to the average price of the most expensive one (110): in four of the six pairs of sequences presented in Table 3, there was no significant difference between the reference price and the average price of the cheapest hotel. The only exceptions are the sequence pairs 9–10 and 11–12, where the clients' stated reference price was significantly higher than the average price of the lowest hotel ( $t(103) = 2.25, p < .05$ ).

To measure the significance of the differences of the three competitive patterns in terms of the reference price, we used ANOVA repeated measures, as all sample subjects saw the three different conditions (*within-subjects treatment*). The reference price differed statistically significantly between treatments ( $F(2, 206) = 7.03, p < .005$ ). We disentangled the impact of each specific treatment using post-hoc tests. Bonferroni correction revealed that the average reference price in the leader–follower treatment was slightly higher than the reference price in the synchronized condition but not enough to hold statistical significance ( $p = .2$ ); however, the independent price condition presented a higher reference price than the synchronized condition ( $p < .005$ ) and the leader–follower condition ( $p < .01$ ). Therefore, we can conclude that an independent pricing system between the two competitors presents the highest reference price. Figure 2 graphically shows the average reference price along with the standard error for each condition.

**Figure 2. Average Reference Price across Conditions**



#### *5.4. Discussion*

The second experiment explored how different pricing strategies for hotels in competitive industries affect the reference price. The reference prices observed would suggest that the optimal strategy for competing hotels would be to not adjust prices simultaneously. Aside from the simultaneous adjustment of prices, we considered the effect of leader–follower strategies (i.e., when one competitor adjusts the price based on the other’s move). We show that consumers tend to lower the reference price if there are two similar price moves between competitors, stating a lower reference price with respect to a situation of independent price moves. These results support H3, suggesting that unfairness inferences are made when one hotel adjusts its prices based on the prices of another.

Interestingly, the reference price stated by consumers tends to be closer to the cheapest hotel, confirming a finding of Experiment 1: when forming their reference price, people do not

take into account only the average of past prices; they are also influenced by past peaks; people generally adapt more to lower prices (and fluctuations) than to higher ones.

Experiment 2 should be seen as a first step towards an understanding of reference-price formation in competitive scenarios; it cannot claim to provide a full picture of all the subtle price differences in real environments.

## **6. Conclusion**

### *6.1. Theoretical and practical implications*

This study contributes to the pricing research on experience products by conducting research in an experimental setting, as advocated by Adhikari, Basu, and Raj (2013).

The reference point framework is relatively well analyzed (Kahneman and Tversky, 1979; Tversky and Kahneman, 1991); however, a sound, in-depth application in the hotel industry is needed. Chen and Schwartz (2008) have underlined that price structures and room rate change patterns affect consumers' room rate expectations and thus their propensity to book. Referring to the two aspects we tested, people tend to overestimate lower prices in forming their reference point and are influenced by early prices, which act as a milestone in the determination of the reference price.

The dynamic nature of reference price formation has to be related to the types of competitive games being played among industry operators. As Netessine and Shumsky (2005) theorized, competitors fight in games that can be described as "horizontal." The authors discuss show an operator experiences a substantial revenue loss, as high-fare customers receive a higher surplus from a competitor. Relating these elements to our findings on reference price formation suggests



that competition and its subsequent price-related behaviors jeopardize not only price perceptions but also revenue extraction from the highest-value customer segments.

Our findings suggest that hotels should be very cautious in lowering their rates to affect the reference price, even for short periods. As theoretically suggested by Kopalle, Rao, and Assunção (1996), we show how pricing and discounting policies affect reference price formation. The more often and longer hotel room rates are discounted, the more likely the discounted rate is to become the reference price, and the more difficult it will be for hotels to recover their value in the minds of consumers. As described by Hunt (2005), a pricing and revenue management expert, less mature companies tend to enter into price wars more easily and use discounts and aggressive pricing tactics in an uncontrolled way. Such companies will jeopardize reference price levels.

We also find that earlier prices in a sequence are strongly influential. This finding appears to be more controversial, as many authors affirm the crucial role of more recent prices. One possible explanation is provided by Danziger and Segev (2006), who observe that, although field studies report robust last-price effects, laboratory experiments do not. They argue that the stronger impact of the last price in field studies is caused by the fact that consumers rarely see the prices. By contrast, in laboratory experiments such as Experiment 1, prices are viewed within seconds or minutes, and early prices therefore seem more recent. This difference between the lab and the field is shrinking due to the influence of the Internet: the relatively new Google hotel finder tool and the increased presence of online price charts (Drechsler and Natter, 2011) allow customers to easily monitor trends in past prices and competitors' prices.

Aside from memory, reference prices are also influenced by many factors (e.g., decision delays and social comparison). Our design includes many of the factors that may matter but may have excluded some others.

The second experiment extends the boundaries of price acceptability in terms of fairness to different competing contexts, showing how the price perceived as fair also depends on the price strategies used by competitors. Our findings show that people tend to “punish” (i.e., reduce the reference price) when competing hotels adjust their prices simultaneously or with a time lag, unlike when prices between competitors evolve independently. This finding supports our hypothesis and the theoretical work of Xia et al. (2004): when competitors adjust prices simultaneously, consumers’ perception of unfairness increases.

Hotels should consider these findings when implementing price strategies. The awareness of reference dependence may facilitate the understanding of online consumer behavior when shaping pricing, especially based on competitors’ moves. If prices are adjusted independently, our findings suggest that dynamic pricing strategies have little influence on reference prices, indicating that revenue management and consumers now accept time-based pricing practices. Nonetheless, boundary conditions apply in markets where competitors adjust prices simultaneously. The negative effect on reference prices highlights how simultaneous pricing adjustments between hotels may induce feelings of unease, thereby leading to the perception of unfairness as well as the lowering of the reference price.

Furthermore, observing sequences with extreme prices, people tend to punish high prices (losses from a consumer perspective), confirming the prospect theory hypothesis that losses loom larger than gains. To limit this effect, the optimal strategy for hotels would be to reduce price

variability, as maintaining stable rates reduces the risk that the reference price will be replaced. The impact of reference prices should be considered when designing new pricing mechanisms such as pay-what-you-want (Johnson and Cui, 2013) and price bidding (Rong-Da Liang, 2014).

### *6.2. Limitations and future research*

This paper is not without limitations. The first experiment involved student participants and service purchase scenarios. We are aware that presenting student participants with a hypothetical design in a lab is less than ideal. We therefore analyzed data from the field before making conclusions. A major limitation is that we presented customers with only two competing hotels with pre-designed sequences of prices to elicit the main effect, whereas realistic online environments present multiple alternatives and prices. The selection of a competing hotel with a slightly lower average price was a choice based on the location of that hotel, which could also be considered geographically close. In addition to the competitive structure, reference prices are influenced by many other factors, such as decision delays, social comparisons, loyalty programs, segment types, destination characteristics, and individual differences. While the study designs allowed us to isolate some of the factors that may impact reference prices, they excluded others. For example, on top of the main trends, there were individual fixed effects of respondents for the findings in both Experiment 1 and 2. Possible explanations for these findings appear in Nicolau (2012) and Baucells and Hwang (2014), who show that people are heterogeneous in their loss aversion and price responsiveness, respectively. An analysis of the determinants of individual differences, which is not the goal of this study, is left for future investigation.

In the second experiment, two of the scenarios presented to subjects (sequences 7–8 and 11–12 in Table 3 and Appendix B) appear to be similar though intended to represent the leader–

follower condition and the independent condition, respectively. The results of the experiment confirm the anomaly of this case. As Table 3 shows, sequences 7–8 present a higher reference price, similar to those of the independent condition. Another limitation concerns the operationalization of the reference price. While we stress that the fair price is a widely used construct for the reference price (Arkes, 2008; Bolton et al., 2003; Campbell, 1999; Rajendran, 2009), we acknowledge that the operationalization of the reference price with multiple hotels, as in Experiment 2, is not straightforward. Our elicitation “the price you would think is neither expensive nor cheap for an average booking” is only one possible elicitation to be drawn from the literature and should be both replicated and improved upon.

One possible avenue for further testing is to examine whether these findings hold even when hotels are able to provide rational reasons (aside from maximizing profits) for why prices move simultaneously between competing hotels (e.g., peak days, seasonality, events). Future research should also explore if these effects hold in other industries where the use of dynamic pricing is increasing (e.g., the retail industry).

Finally, to reconcile the different conceptualizations of the reference price, it would be interesting to investigate if an elicitation of the reference price other than in its fairness conceptualization would generate a different effect on the reference price. We imagine that an operationalization closer to the expected price conceptualization would tell an entirely different story. In fact, in this case, people may set aside unfairness considerations to focus on rational considerations from past prices and the behavior of competitors.

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**Appendix A. Screenshot of experimental scenario (Experiment 1).**

Price 100
Price 150
Price 100
Price 50
Price 100
Decision <input type="checkbox"/>
<input type="button" value="OK"/>

**Appendix B. Graphical representation of sequences seen by participants in Experiment 2.**

