Exotic Reservations- Low Price Guarantees

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Abstract

The increase in the volume of internet online bookings has had a major impact on distribution channels in the hotel industry. The popularity of such services stems from the consumers' desire to obtain the lowest rate within their desired market segment. One possible cure is to offer the best rate guarantee. We show that current rate guarantees are essentially worthless to consumers; and demonstrate how a hotel company can structure a best rate guarantee that would provide value to consumers. In addition, we show, using a well-established exotic option pricing formula, how to price this best rate guarantee so that consumers would be willing to pay for the option.

Introduction

The increase in the volume of online bookings through the internet has had a major impact on both distribution channels and profitability in the hotel industry. According to the consulting firm Forrester Research, sales of online leisure hotel rooms doubled in 2002 to $2.7 billion. Research indicates that one in three hotel rooms will be booked online by 2006, up from less than 1 in 10 in 2002 (Carroll, 2004). While this growth of online bookings has driven up the profits and market values of online travel companies, the increasing use of the internet by consumers has not necessarily had a similar positive impact on profitability for the lodging industry.

This growing trend may be, in part, fueled by consumers who increasingly view hotel room services as homogeneous within given segments, with rooms from one brand serving as a near perfect substitute for rooms from another. This indifference, when it exists, results in consumers choosing their hotels based on the lowest rates available and is facilitated by searching among the various distribution channels. Not surprisingly, third-party online travel service (OTS) companies, such as Expedia, Orbitz, and Travelocity, have become extremely popular largely due to their ability to facilitate the consumer with a low-cost search. By making it easier and less ''time costly'' to compare room rates between

different hotels, these online travel service companies have empowered the consumer with the information to comparison shop for rooms given a stated quality and rate preference.

The pricing and discounting of these rooms are accomplished through what is known as the merchant model, whereby OTS companies are assigned blocks of rooms at far below standard current market rates who then resell the rooms over the internet at significant mark-ups. Extensive use of third-party internet bookings under the merchant model has resulted in the erosion of the unified pricing plans that are favored by the brand-name hotel companies. It is reasonable to anticipate that as the practice of shopping for rooms on the internet becomes more widely accepted, hotel companies will continue to battle for control and market influence over their pricing structure, inventory of rooms, and their ability to foster brand loyalty.

The lessening of control over pricing of rooms within a brand and the potential transfer of pricing authority to third-party OTS companies stem from the consumers' desire to obtain the lowest rate within their desired market segment. From the perspective of the consumer, room rates offered by comparable brands within a competitive set are uncertain and unknown at the actual time the reservations are made. In Carroll (2004), 69% of online travel buyers shopped two or more web sites for a hotel room in 2003. Therefore, when making the initial reservation the consumer will often choose to visit the various distribution channels, including the hotel's own web site, seeking the lowest rate for hotels within their chosen segment and location. Furthermore, because rates often change prior to their reservation arrival date, consumers face uncertainty in rates over time even for the same hotel in a given market. As a result of these combined forces, consumers will often continue to search after having made their initial reservation in hopes of identifying a lower priced hotel room that represents, in their own mind, a reasonable substitute to the room already booked. If one is located prior to the cancellation deadline the customer will cancel the initial reservation and re-book at the lower rate.

It may be attractive for hotel companies to believe they can regain control over the pricing process though improved brand differentiation, tighter standards on room inventory and partnering with other companies to form distribution alliances. However, the strong incentive of consumers to search for and book rooms at the lowest price suggest that another potential solution to this problem lies in dealing with the consumers' incentive to search. Our proposed solution has the capacity to eliminate the need for consumers to search for lower rates, and therefore increase retention of the brand's customer base and relies on eliminating the price uncertainty they face when making a

reservation. If this uncertainty can be resolved at the time of the initial reservation, there will be no incentive for consumers to seek lower rates from third party online distributors' channels.

We propose that, by providing alternative forms of reservations, any hotel can effectively eliminate the incentive of the guest to search and therefore eliminate the probability that the consumer will cancel their reservation and switch to a comparable room at a different hotel or even an identical room in the same hotel. Our model builds on the work of Quan (2002) who showed that a hotel reservation can be compared to a financial European Call Option given by the hotel to the guest— that is, the guest has the right but not the obligation (since they can cancel costlessly, within the cancellation period) to purchase the bundle of services associated with a hotel room at a specific date in the future at the set reservation price. A key insight from Quan's work is that a reservation given by a hotel is valued by the customer (and costly to the hotel) since it commits the hotel to sell at a fixed price when the actual rates on a given day are uncertain to both the customer and the hotel.

In this paper, we expand upon this concept and propose an ''exotic'' reservation to address the hotel industry's immediate concern as described in our opening—the migration of customers to third-party OTS companies and the subsequent search and switch behavior of consumers continuing to seek lower room rates. The term ''exotic'' in describing our reservation is appropriate since the analogous financial option is often classified as an exotic option in that it represents one of a class of special options priced under a special set of circumstances. Specifically, as a solution to the problem of customer migration, we propose a guaranteed lowest-price reservation which is analogous to a put option on Extrema. In this type of ''exotic'' reservation, the guest is guaranteed to pay the lowest price offered and booked at the hotel distribution channel employed throughout the period of the reservation. We determine the value of this guarantee and in doing so determine the price that the hotel should charge for this guarantee. By providing the guest with the assurance they will pay the lowest rate offered to transient guests on a given day, there will be no incentive for them to search elsewhere, thereby eliminating the deleterious effects of search and switch behavior on hotel profits while simultaneously allowing hotel companies to reassert control over the pricing of their rooms. Furthermore, we use the model to determine the value of existing low-price guarantees presently offered by many hotel companies. It is found that such guarantees in their present form have little value to the consumer and therefore do not provide the price guarantee feature that our proposed ''exotic'' reservation provides.

Distribution Channel Attempts to Addressing the Post-Reservation "Search and Switch"

Behavior

In response to their desire to regain more control over their brands' pricing, hotel companies have devised mechanisms to both circumvent online travel service companies and provide disincentives to booking rooms with these distribution channels. One such example is Travelweb.com, a site owned by Dallas based Pegasus with partners Hilton Hotels, Hyatt, Marriott International, InterContinental Hotels Group, Starwood Hotels, and Resorts and Priceline.com. This partnership is designed to circumvent the need to use third-party online travel sites, created as an online travel company, but one that is owned by the hotel partners themselves and one where the maximum mark-up within the merchant model is limited to 15–20%. However, the ability to control price discounting in this manner is dependent upon the proportion of the total rooms controlled by the partners in any one market leading this pricing/inventory control strategy to have had little success.

Another mechanism being employed to regain control over consumer hotel booking behavior is limiting frequent travel points to those rooms booked over the company's own web site or over other approved vendors. Hilton Hotels, for instance, no longer offers HHonors points and mileage to people who booked rooms on bargain web sites. This is designed to provide a clear disincentive to customers seeking to find lower prices on discount online travel agents by denying any frequent traveler points for that stay. This incentive will only work up to the point where consumers value the marginal miles earned by that stay more than the amount saved per room night by booking on the discount online travel service company. Since the rooms booked over these sites often save customers from $10 to $40 or more per night, the value of the frequent traveler points lost will often be far less than the amount saved. Also consumers can buy their frequent traveler points and make up the difference in their point balance much more cheaply than forgoing lower room rates and reserving rooms only on the hotel's own web site. Specifically, HHonors currently provides guests with 10 points per dollar spent, or a value of $0.10 per point. However, the purchase price of points, according to the HHonors web site only costs 0.01 per point. This means that consumers would be far better off reserving the hotel at a lower rate and purchasing their points online through the HHonors web site.
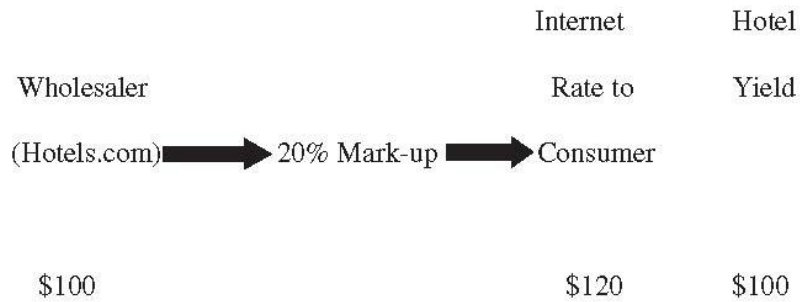
The First Attempts at the Lowest-Price Guarantee

A different approach to controlling the flow of guests who make their reservations through internet travel discounters has been introduced by hotel companies such as Hilton, Cendant, and

Starwood. These companies have instituted lowest price or ''best rate guarantees'' on reservations made through the company's online booking services. These programs offer the assurance that; if after a guest has booked a room using the hotel's brand web site and the guest finds a lower rate for the same room on the same day at the same hotel sold on any online distributor web site, the company will match the lower rate. Most programs even offer an additional percentage discount on the match price, say 10% or a gift card, if a lower rate is found.
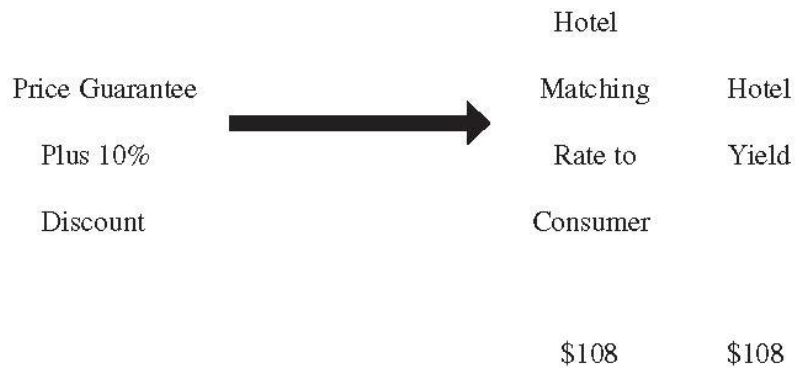
The best price guarantee program offered by Cendant provides an example. The Cendant best price guarantee promises that if customers find lower published rates for their hotels through any other online distributor, Cendant will match the lower rate plus an additional 10% discount. The customer must first book a reservation using the brand web site. If within a 24 h period from the time of booking the customer finds a lower rate online, they must submit the lower rate via an e-mail to their customer service department who must then verify the information. If verified, customer service will provide the matched rate plus a 10% discount reservation. Such programs attempt to provide consumers with the assurance that the rates offered at brand web sites are the lowest available, and therefore there is no need to shop for lower rates at other online booking sites.

The availability of rooms offered by third-party internet sellers is largely determined by the willingness of franchisees to sell their rooms to these providers. To discourage such activities, the hotel companies often make the case that by participating in such best price guarantee programs, franchisees can earn a higher room yield than if they had sold their rooms. The benefit to the franchisee of participating in this program comes from the observation that the franchisee's room revenue from the matching price and the discount is higher than if they had sold the room to third-party sellers. This is due to the higher mark-up that third-party sellers require with the so-called merchant model as compared to the resulting mark-up from selling a room at the best price guarantee with the hotel company.

For example, assume a room is sold to the wholesaler for $100. Given that the usual wholesaler mark-up is 20%, the wholesaler would sell this room at their web site for $120. If the room is sold by the wholesaler, the hotel realizes a yield of $100 for the room.

		Internet	Hotel
Wholesaler		Rate to	Yield
(Hotels.com) ➡	20% Mark-up ➡	Consumer	
$100		$120	$100

Now consider the price guarantee:

		Hotel	
Price Guarantee	➡	Matching	Hotel
Plus 10%		Rate to	Yield
Discount		Consumer	
		$108	$108

It is often pointed out by the parent hotel company that with the price matching program, the hotel will be betteroff to not sell their rooms to the wholesalers. So long as the mark-up for the wholesaler is higher than that of the hotel, the price guarantee reservation will always be able to undercut the wholesaler and retain a higher yield for the rooms. Although such programs appear to give the guest the assurance that by booking at the brand's web site they would be assured of the lowest rate, in actuality, as shown in Quan (2002), the 24 h time limit from the day of the reservation makes this guarantee essentially worthless.

A more valuable and realistic best rate guarantee can be developed and priced whereby the hotel can offer a rate that is guaranteed to be the best rate that a consumer will ever be able to find for that room (or a comparable room) from the date of the reservation until the date of arrival. In effect, the company would be eliminating the consumer's incentive to search the web for cheaper room rates as the arrival date approaches. Experience tells us that as the arrival date approaches there is often significant unsold inventory. When such unsold room inventing exists this will trigger larger amounts of

rooms being released to discount online travel service companies and provide a growing population of more deeply discounted rooms being made available on the internet. Any best rate guarantee that does not take into consideration the shopping behavior of consumers and discounting behavior of sellers cannot be of value to either the consumers or the underlying needs of hotel companies to control customer migration following search and switch activities.

Reservation Guarantee- Conceptual Issues

The present problem facing the hotel industry as a result of internet shopping is basically similar to a problem that has been well explored in the economic literatures in broad area of information economics. The seminal works in this area include Akerlof (1970) and, more related to our model, Spence (1973) and Stiglitz and Weiss (1981). In the context of hotels, there is information asymmetry between the hotel operator and the guest. The guests have diverse private information and preferences as to their rationale to purchase a room at a specific hotel. Different guests may be motivated by different hotel attributes, these include among others, brand loyalty, the location of the hotel, the service the hotel offers, and of course, the price paid. If the hotel could perfectly observe each guest's set of preferences in all dimensions, they would then be able to price discriminate and charge a different room rate based on each consumer's willingness to pay. An example of this practice is the pricing of higher room rates for weekdays, when price insensitive business travelers book their rooms, and discounting during the weekend, when leisure travelers often book.

However, from the hotel operator's perspective, they do not generally explicitly observe such differences when they set their transient reservation booking policies. Thus it is not surprising that no single policy will be suitable for all customers given the diverse nature of their tastes and preferences. To achieve a closer correspondence between the rate charged and the consumer's willingness to pay, it is reasonable to explore the possibility of offering alternative reservations in the hopes that they serve the customers better and at the same time increase the customers' interest in staying at the hotel.

Our suggested solution to resolving this issue is to offer a menu of different types of reservations and have the customers self-select and thereby provide a better match between the needs of the guest and the hotel operator. In implementing the specific reservation model presented here, we target one dimension of a room booking that OTS companies emphasize—room rates. By offering a modified reservation with an option, those guests who are most sensitive to price uncertainty will choose to select the ''exotic'' reservation while those who are less sensitive and those who have a

strong brand loyalty, will select the conventional method of booking, as a lower price offered in the future at a competing property would not motivate them to switch their reservation to the other property. Therefore, our model does not ignore brand loyalty— the group that values brand loyalty above any price differential is still being served by the normal reservation process. However, guests who have migrated to third-party web sites and are engaged in search and switch behavior would find the ''exotic'' reservations format attractive.

In broad terms, our proposed reservation model takes into explicit consideration differences in the preferences of hotel guests and their heterogeneous valuation of room services. Customers chose hotel rooms for a variety of reasons, including brand loyalty, location, service, and, of course, price. By introducing our proposed reservation format, concurrent with conventional forms of reservations, we specifically target those customers whose room decisions are motivated primarily by price rather than by brand or another attribute specific to the hotel. This is achieved by designing a set of terms in our proposed reservation formats such that price sensitive customers, the same ones who use OTS companies to shop for the lowest price regardless of brand, will find it in their best interest to self-select and therefore willingly adopt our proposed reservation terms. For those guests whose booking practices are largely driven by brand (or other reasons), our alternative reservation option (given its cost) will be less appealing and therefore these consumers will likely find conventional room reservations preferable.

The Low-Price Guarantee Model

The low-price guarantee model would work as follows: a guest makes a reservation for a room at price R at $t = 0$ for a $t = T$ check-in. The hotel guarantees that the price the guest will pay at $t = T$ will be the lowest web-published price for the room from $t = 0$ until check-in, if the lowest web-price is less than R. If the lowest price over this period is above R, the guest will pay R, the rate promised by the reservation for the room.

Thus a guest, in the absence of this low-price guarantee, will pay R at check-in for the room. At the time of booking, the future web-published prices are unknown and may change for a variety of reasons. Although there is future price uncertainty, the guest, by making a reservation, has essentially locked in a price R for the room and therefore has eliminated any price uncertainty.

Define the lowest web price over the period $t = 0$, T as

P_{min}. That is,

$P^{min} = min(P_0, P_1, P_2, \ldots, P_T)$.

By accepting the low-price guarantee, the benefit to the guest is the difference between R and P_{min} if $R > P_{min}$. Alternatively, if $P_{min} > 4$ R over the entire period, the low-price guarantee does not yield a payoff since the guest will pay R, the price the guest would have paid in the absence of this guarantee. Thus the payoff for the guest from receiving this guarantee is

$$\text{guarantee payoff} = \begin{cases} R - P_{min} & \text{if} \quad R > P_{min}, \\ 0 & \text{otherwise.} \end{cases}$$

Conceptually, this option gives the guest the right (but not the obligation) to sell the room back to the hotel at R, the reservation price, for P_{min}. Clearly this will only be profitable if $P_{min} < R$. Thus the guest will only do so if the minimum price experienced is lower than the reservation price. Note that this is the same payoff as if the guest exercises the put option optimally. This is sometimes called a put option on Extrema (Conze and Viswanathan, 1991) since the condition of the payoff is dependent on an extreme value (in this case, the minimum price achieved). Conze and Viswanathan showed that for the case $R < P_0$, the value of this option, V, is defined as

$$V = -P_0 N(-d) + e^{-rT} P_0 N\left(-d + \sigma\sqrt{T}\right) + e^{-rT} \frac{\sigma^2}{2r} P_0$$
$$\left[-\left(\frac{P_0}{R}\right)^{-2r/\sigma^2} N\left(-d + \frac{2r}{\sigma}\sqrt{T}\right) - e^{rT} N(-d)\right]$$

For the case $R > P_0$,

$$V = e^{-rT}(R - P_0) - P_0 N(-d') + e^{-rT} P_0 N\left(-d' + \sigma\sqrt{T}\right)$$
$$+ e^{-rT} \frac{\sigma^2}{2r} P_0 \left[N\left(-d' + \frac{2r}{\sigma}\sqrt{T}\right) - e^{-rT} N(-d')\right],$$

where

$$d = \frac{(\ln(P_0/R) + rT + (\sigma^2 T/2))}{\sigma\sqrt{T}},$$

$$d' = \frac{(rT + (\sigma^2 T/2))}{\sigma\sqrt{T}}.$$

In the above, r is the risk-free interest rate and $N(\bullet)$ represents the cumulative distribution function of a standard Gaussian variable. $\eth$ represents the volatility of prices and is a measure of the price uncertainty over future T periods. In the next section, we will elaborate on how the volatility parameter can be calibrated with historical room rate information.

The Nature of Hotel Price Uncertainty

A low-price guarantee has value because it offers the guest protection against uncertainty in future room rates provided by competing hotels. Since it is this uncertainty that drives our model, it is important to understand how it is characterized and how it relates to more familiar existing yield management practices that attempt to take such factors into consideration.

Our model of hotel room price uncertainty parallels closely those developed in the financial options-pricing literature. An option is viewed as a contingent claim on an asset whose future returns are uncertain. Since the option's payoff is contingent on the asset's future return, the option's value today is a function of the probability of having a positive payoff in the future. This probability is determined by the specification of a stochastic process which characterizes the distribution of future returns. Thus uncertainty is modeled as a stochastic process which provides a probabilistic characterization of future returns. The overall return process is viewed as being comprised of a deterministic predictable component, or drift term, and an unpredictable stochastic component. Because an option is a claim on some unknown future value of the asset, its value is dependent on the stochastic component of returns and not on the drift term. Thus in the calibration of option pricing models, whereby uncertainty is measured as the volatility of the stochastic component, the uncertainty is often measured as the standard deviation of returns after returns have been purged of all predictable movements. For a readable presentation of these concepts, see Cox and Rubinstein (1985) or Hull (1997).

In our hotel reservation application, we analogously envision hotel room prices movements over time as being comprised of these two components. In the context of hotel room rates, reasonable measures of predictable price movements are those that are forecasted by conventional yield management models. One function of yield management is to predict future room occupancies or rates using a variety of forecasting models, ranging from time series models such as exponential smoothing and ARIMA models to advanced additive and multiplicative booking models (Kimes and Weatherford, 2003). Predictions from such models represent the best estimates of the future and therefore capture

all the predictable movement in future prices or room occupancies. Given this interpretation, the stochastic component can be simply viewed as the forecast errors or the residuals from the application of yield management models. Thus, a reasonable estimate of uncertainty or volatility is the standard deviation of the error term in yield management forecasts.

Since the value of our low-price guarantee reservation is dependent on the size of the unpredictable component, it is important to get an indication as to its magnitude. Due to the wide use of yield management practices, there have been numerous studies which have attempted to quantify their accuracy. In a study comparing the forecast performance of regression, pick-up and multiplicative models, the mean absolute percentage error (MAPE) of forecasts ranged from 10% for the pick-up and regression models to over 200% for the multiplicative model (Kimes and Weatherford, 2003). In another study of group bookings, the MAPE ranged from 10% to 15% on the day of arrival to 40% at 2 months before arrival (Kimes, 1999). Although such studies have focused on the performance of room occupancy forecast, this information is in turn inputted into yield models that in turn determine the appropriate prices to charge for rooms. It follows that errors in room predictions will likely translate into errors in room pricing and that a substantial amount of future changes in room demand is unpredictable.

Properties of the Low-Price Guarantee Model

An important and intuitive property of our guarantee pricing model is that value of the price guarantee decreases as we approach the check-in date. This is intuitive because the value of this commitment is largely based on the probability that we will find a lower competing rate. Since room rates do not normally change continuously, the probability of finding a lower rate the day before check-in is smaller than the chances of finding a lower rate a week before check-in. In fact, if the reservation was made a year in advance, the price of the price guarantee increases to $14.63. The value of the price guarantee over the entire year is plotted in Fig. 1.

From the pricing formula and the previous description, clearly the most important step in the implementation process is in selecting the volatility parameter ð. In the options literature, ð is estimated by calculating the standard deviation of price movements using a series of part prices which are presumably representative of future price movements over the option's maturity. In the context of applying this to hotel reservations, it is important to reiterate that this parameter reflects the *unpredictable component* of price movements rather than a simple volatility measure of room

rates. It is also interesting to note that under the Cendant policy of finding a lower price within 24 h that the value of such an option, given our assumed parameters, is $0.00000004!
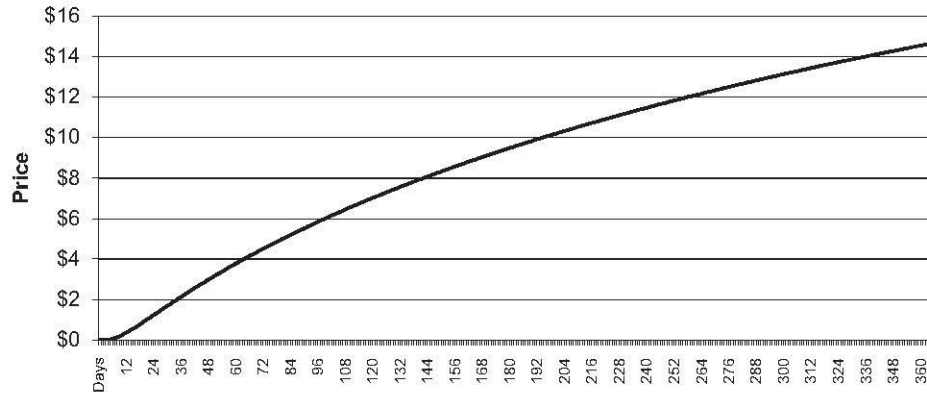

Fig. 1. Price of a minimum price reservation (1 year with 30% annual volatility).

Volatility Calibration to the Merchant Model

In the application of this model in the wholesale merchant model, we need to establish a realistic volatility calibration of our model. In the merchant model, a hotel sells its room to a wholesaler who in turn lists the room on the internet at some mark-up, typically in the 20% range. If we are to price the guarantee reservation for the merchant model, it is important that we calibrate the model parameters to mirror the terms.

Using our previous numerical merchant model example, when a room is sold to the wholesaler for $100 who in turn sells it on their web site for $120, it is clear that wholesaler will never sell the room at any rate lower than $100, the price they paid for the room. Thus in terms of the future price for the room, the price will have a lower bound of $100. A key parameter in our model is the volatility of future room rates which determines the likelihood that the guarantee will be binding. Thus in order to calibrate our model, our measure of future price volatility must incorporate the fact that likelihood of observing a price lower than $100 is highly unlikely. This feature must be incorporated into our choice of the volatility parameter. One way to handle incorporating this information is by selecting a volatility measure such that there is an effective zero probability that future prices will be lower than the wholesale price of the room. Let K designate the wholesale room price. The wholesaler's mark-up is assumed to be m% and let P be the price the hotel currently charges for the room. Thus if we use our

previous model of an extrema option, the volatility we are referring to is the volatility of the wholesale room rates.

To constrain our volatility parameter, we note that our pricing model is predicated on the assumption that the dynamics of the hotel room price process follows a Brownian price process

$$\frac{dP}{P} = \mu \, dt + \sigma \varepsilon \sqrt{dt}. \tag{0.1}$$

Assuming Brownian motion in the formation of the hotel room price process, the price of the room at time *T* or the check-in date, is P (*T*) which has the following form

$$P(T) = P(t) \exp\left\{ \left(\mu - \frac{\sigma^2}{2} \right)(T - t) + \sigma \varepsilon \sqrt{T - t} \right\}. \tag{0.2}$$

Thus for our model, we would like to calibrate our volatility ð such that the probability of the price being less that K to be very small. We see that by rearranging the terms, this probability is

$$Pr[P(T) < K] = Pr \, P(t) \exp\left\{ \left(\mu - \frac{\sigma^2}{2} \right)(T - t) \right.$$
$$\left. + \sigma \varepsilon \sqrt{T - t} \right\} < K, \tag{0.3}$$

which is equivalent to

$$Pr(\varepsilon) < \frac{\ln\left(\frac{K}{P(t)}\right) - \left(\mu - \frac{\sigma^2}{2}\right)(T - t)}{\sigma\sqrt{T - t}}. \tag{0.4}$$

By definition of a Brownian process, E~ N(0,1) thus we can select a value for ð such that this probability is extremely small. From the normal tables, we can select a probability for the unit normal random variable which has a very low probability of occurring. Consider *PR(E)<-3*=0.00135. We can solve for the volatility ð such that the right-hand side of the above expression is equal to -3. In essence, we would like to solve for ð such that

$$\frac{\ln\left(K/P(t)\right) - \left(\mu - (\sigma^2/2)\right)(T - t)}{\sigma\sqrt{T - t}} = -3. \tag{0.5}$$

Numerical Example

Using our previous example, let today's room rate be $125 (*P(t) = 125*) and assume that the historical mean price for this room was at $120 *(u=120).* We consider a 1 year time period (*T*=1). Let the whole sale price of the room be $100(*K*=100). Substituting these values into the above expression and simplifying we get

$$\ln\left(\frac{100}{125}\right) - \left(120 - \frac{\sigma^2}{2}\right) + 3\sigma = 0.$$

Solving for the volatility we see that a value of will satisfy our priors about the volatility parameter.

Conclusion

This paper is the first to propose a specific use for and price an exotic option as applied to hotel reservations. We begin by asserting that the observed search and switch behavior of consumers and the loss pricing control by hotel companies are both connected to consumers' incentives in the market combined with the advent of internet OTS companies. We continue by proposing that one possible cure for the problems currently facing hotel companies in their quest to maintain price integrity is to offer the best rate guarantee. While the current best rate guarantees offered by hotel companies are shown to be essentially worthless to consumers, we show how a hotel company can structure a best rate guarantee over an extended period of time that would provide value to consumers. In addition, we show, using a well-established exotic option pricing formula, how to price this best rate guarantee so that consumers would be willing to pay for the option. Using this approach hotel companies should be able to eliminate the incentive for consumers to engage in search and switch behavior, re-establish the price integrity of their product while simultaneously creating a revenue stream from the sale of the best rate guarantee options to their customers.

The best rate guarantee is only one of a family of exotic option that could be offered to consumers by hotel companies. Our preliminary analysis has identified the following other exotic reservations that may have potential value to hotel reservations managers and corporate travel executives (CTEs) to deal with the risk inherent in managing room needs for high and frequent demand customers.

(1) *Down-and-in barrier call options*—with a down-and-in call option, the customer can purchase a guarantee whereby if the actual room rate charged rises above some level, *P**, the customer will receive the difference thereby insuring that the maximum price charged will be *P*.*

(2) *Exchange option*—under this contract a corporate customer can switch a reservation in one hotel for one in another property of greater quality without being subject to a higher rate. This kind of option would be useful if a corporate travel executive was booking rooms for a business meeting where they were unsure of the distribution of executives who were planning to attend. Dependent on whether the president, senior vice-presidents, or vice presidents were attending a different level of room reservation would be required. An exchange option allows the CTE to reserve a room within a system, such as Marriott, and know that the room is reserved at a given rate at a Marriott or a Ritz Carlton at the same rate on a given day.

(3) *Average-price and average strike call option*—Under this contract a good corporate customer receives a guarantee that a the price paid for a series of rooms over a set time period will not exceed some pre-specified average daily rate. This type of contract would allow a CTE to know in advance the overall average daily rate that they will pay for a given number of rooms over a set time period and therefore allow them to set their budgets with a much improved level of precision. We expect that, future research will price each of these, and other exotic options, and in so doing add a set of new tools for hotel companies to manage the growing complexity of hotel pricing in an internet connected world.

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