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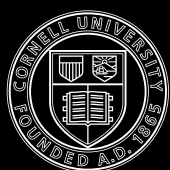
Optimizing Hotel Pricing: A New Approach to Hotel Reservations

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by Peng (Peter) Liu, Ph.D.

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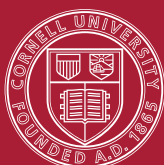
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Optimizing Hotel Pricing:

A New Approach to Hotel Reservations

by Peng Liu

EXECUTIVE SUMMARY

This report discusses the economic basis and provides a description of a new hotel reservation pricing approach. In addition, the second half of this report provides a step-by-step key to the screens and functionality of the companion *Cornell Hospitality Tool*—“Hotel Reservation Optimizer.” The tool applies a general equilibrium approach to establishing a value for a room reservation. The room reservation is essentially an option to occupy a room at an agreed-on room rate. By establishing a price for the reservation that is based on the traveler’s best estimate of whether she will actually occupy the room, the hotelier gains information about how likely it is that the room will be sold. This tool is a mechanism by which hotel managers can obtain more accurate information regarding future room demand.



ABOUT THE AUTHOR

Peng (Peter) Liu, Ph.D., is an assistant professor of real estate at the Cornell University School of Hotel Administration. He joined Cornell's faculty in 2007 after obtaining a Ph.D. in finance and real estate from the Haas Business School at University of California Berkeley. While obtaining his doctoral degree, Liu taught courses in stochastic calculus, credit risk and mortgage-backed securities. His primary research focuses on asset pricing and hedging in the real estate market, with specific interests in mortgage pricing, mortgage-backed securities and commodity futures research. Prior to his career in academics, Liu worked in various industries, including engineering, advertising, consulting, and hedge funds.



Optimizing Hotel Pricing:

A New Approach to Hotel Reservations

by Peng Liu

The hotel industry is among many service industries that use reservations as a sales mechanism. In the past century, a hotel reservation often meant making a request for a room by mail, telegram, telex, or telephone. As technology improved, chains competed with each other to offer faster and more comprehensive reservation systems. Two principles supported these early reservation systems. First, the room rates were relatively sticky, and unlikely to change from the time of the reservation to the time of guest arrival. Second, when the guest made the reservation the (quite reasonable) expectation was that the guest would, in fact, occupy the room. Thus, a reservation indicated a high probability that the room-night in question was sold.

In this century, both guests and hotels treat reservations in a far more sophisticated manner. Hotels may adjust their room tariffs many times between the moment a guest makes a reservation and actually occupies the room. Some of those adjustments occur on third-party sites that may not even identify the hotel in question. By the same token, the guest who makes a reservation (being aware of hotels' practice of changing room rates) may continue to search for a different price or even a different hotel for the proposed travel dates. Moreover, even if the guest pays no particular attention to the room rates, there is still the question of whether the trip will occur at all—a situation that typically applies to business travelers. So, hotels face a challenge of asymmetrical knowledge—that is, the guest has a much better idea than the hotel does of whether she will actually occupy the room she has reserved. Hotels, of course, use their revenue management systems to estimate these probabilities based on past history. Although the hotel industry has become quite adept at making such probability estimates, hotel operators still face substantial challenges, such as reservation cancellation and overbooking. The reservation method I explain here mitigates this problem by encouraging guests to disclose their trip probability and thereby reduce the information asymmetry. I call this method the Hotel Reservation Optimizer. First I will discuss how this approach operates, and then I offer a specific step-by-step guide to the Hotel Reservation Optimizer, which is a tool that will assist hoteliers in making the most of the value of a room reservation. Note that although I discuss this concept in the context of the hotel industry, it applies to other service businesses.

The concept I discuss here is that the room reservation is, in fact, an option to rent a room-night at a particular agreed-upon rate. The reservation is a thing of value for the guest, who is assured of a place to stay and has confirmation of the price of those accommodations. For the hotel, the reservation provides at least a small window into demand for the date in question. Although hotel and other service firms rarely charge guests expressly for the privilege of placing a reservation, rate fences and other practices (such as nonrefundable reservations) implicitly account for a reservation's option value, as I discuss more in a moment.

Motivations

Cornell professor Daniel Quan was the first to directly address the issue of the value of the reservation as an option, noting that customers' access to the internet, which showed hotels' real-time inventory, allowed guests to make a reservation and then continue to search for a lower-price accommodation.¹ He observed that traditional hotel reservations usually price both the right and benefit of a reservation as a bundle. That is, the value of a reservation for most service products is contained in the price of that product. Quan argued that because a reservation has value as an option, that option should be priced separately from the service. He wrote: "Reservations can provide a form of price insurance which consumers can use to 'lock in' a price for the future delivery of the service. When there is future price uncertainty, such a commitment is costly to reservation issuers." He shows that for price-sensitive customers hotel reservations are analogous to financial call option contracts written by the hotel and given to the guests. Following that initial discussion of reservations as options, Cornell's Steven Carvell subsequently joined Quan to extend the option pricing methodology to low-price guarantee and other exotic reservation products.²

Support of Quan's thesis that hotel guests might well treat reservations as options came from an unrelated study by Cornell professor Gary Thompson and graduate researcher Andrea Failmezger.³ In the mid-2000s, they documented that price disparities among various reservation channels could encourage customers to book a room but then continue to conduct searches for lower prices. Hotel chains have made progress on price consistency since that study (for example, by implementing lowest-price pledges

¹ Daniel C. Quan, "The Price of a Reservation," *Cornell Hotel and Restaurant Administration Quarterly*, Vol. 43, No. 3 (June 2002), pp. 77–86.

² See: S.A. Carvell and D.C. Quan, "Exotic Reservations—Low-price Guarantees," *International Journal of Hospitality Management*, Vol. 27, No. 2 (2008), pp. 169–169.

³ See: Gary M. Thompson and Alexandra Failmezger, "Why Customers Shop Around: A Comparison of Hotel Room Rates and Availability across Booking Channels," *Cornell Hospitality Reports*, Vol. 5 No. 2 (2005), Cornell Center for Hospitality Research.

Comparison of general equilibrium and partial equilibrium approach to hotel reservation

	General Equilibrium Approach	Partial Equilibrium Approach
Pricing Method	The value of reservation is priced separately from hotel room rate as a real option	The value of reservation is priced separately from hotel room rate as a financial option
Application	All guests, especially business travelers	Price-sensitive (leisure) travelers
Room Rate	Jointly determined with reservation price	Exogenously given
Value to the Provider	Obtain valuable information about true probability of consumer needs. Such information can be used for yield management.	No value to provider. Reservation options are issued at the provider's cost.
Value to the Guests	Financially rewarded for revealing true probability of demand and has flexibility in revising demand probability.	Lock in a price and obtain a right to search for cheaper room rates
Benefit to Guests with Small Demand Probability	Encourage guests with small demand probability.	No difference in terms of guest demand probabilities
Impact of Price Volatility	The reservation value is still positive even if the room rate does not change	No value if rate volatility is zero. The higher the volatility the higher the reservation value.
Uniqueness of Reservation Value	Non-unique value. Reservation value is priced in a narrow range. Provider can decide how much to charge the guest for reservation depending on provider's aggressiveness and market power.	Unique value which is determined by Black-Scholes option pricing model

for their web sites), but room rates still vary due to revenue management and other competitive considerations.

In his initial study, Quan acknowledged that he approached the reservation with what is known as a partial equilibrium view, which does not account fully for the provider's profit function or the consumer's utility function. Instead, the mechanism I demonstrate here uses a general equilibrium approach that takes into account the value of the option both in terms of guests' utility and the value to the hotel. The differences between the two approaches are summarized in Exhibit 1, which is taken from a forthcoming *Cornell Quarterly* article.⁴ In technical terms, this method prices the reservation option by jointly solving the utility maximization problems of both the provider and the guest. In common language, this tool will give both guests and hotel operators the opportunity to get the most value from a hotel reservation. For those who would like to see the mathematical solution to this problem, I explain the solution to this general equilibrium "problem" in a companion article which I wrote for the *Cornell Hospitality Quarterly* and from which I drew Exhibit 1. You may also contact me and I will share the mathematical derivation of the optimization equations. The mathematics is complicated, but the principle

is straightforward. By pricing the room and the reservation separately, both parties can gain the value they seek from the room transaction. Let me explain how this works.

As everyone knows, a reservation secures the availability of a service. We have also seen that it grants the purchaser the opportunity to search lower-price alternatives, while still retaining the initial option. Also well known is that when the guest makes the reservation, the service provider obtains at least some indication about prospective consumer demand. While this indication is not entirely reliable, hotels use these reservation numbers to improve their revenue management analysis. The critical piece of missing information is the probability that the guest will honor the reservation and occupy the room.

But what if there was a way to encourage the guest to reveal that key piece of information? My contention here is that this can be indeed accomplished by setting the price of the option and room rate as two concurrent but individual values that jointly maximize the utilities of the room transaction for both the potential user and the service provider. That is, the price of the reservation and the price of the room change according to the likelihood that the guest will actually purchase the room—as determined by the guest. Thus, this framework simultaneously accounts for the value of the reservation to the guest and to the hotelier. The way that the guest reveals that critical piece of information regarding the

⁴ Peng Liu, "Pricing Reservations: A General Equilibrium Approach," *Cornell Hospitality Quarterly* (forthcoming).

probability of travel is by selecting a combination of room rate and option price. The Hotel Reservation Optimizer described here allows hoteliers—and indeed any service operators—to set their reservation systems to gain this critical information about the guest’s likelihood of travel.

One may initially think that setting a separate price on a room reservation makes no sense, since the guest is unlikely to pay for something that is available for free. But let’s look at present practices in which the service provider implicitly charges for a reservation. This is found in two common reservation patterns, which represent the extremes of implicit reservation charges. At one end of the scale is the reservation that may be freely canceled, which is typical of most hotel operations. This carries a reservation charge of zero, which also requires the guest to reveal nothing about her likelihood of travel. But this transaction may also involve a relatively high room rate.

At the other end of the scale, the non-refundable purchase effectively represents a fully prepaid reservation. In this type of reservation the guest pays a significantly lower rate for the room-night, but the payment is not refundable.⁵ By purchasing a nonrefundable reservation, the guest has indicated a 100-percent probability that the room will be occupied. We think of nonrefundable reservations mostly in connection with the airline industry, but I note that hotels are beginning to offer nonrefundable reservation packages that include a reduced room rate compared to the typical room rates on the same date. For example, I noted that for a date in 2011, the Sheraton New York Hotel and Towers offered two different prices for a similar room that amounted to two different products. One product is the traditional reservation at a particular price. The other is clearly a different offer, a nonrefundable reservation for a room at a price that is 10-percent lower than the traditional reservation.

This is just one example, but this hotel is by no means alone in making these nonrefundable offers. This is a large step toward expressly separating the cost of the option and the price of the room. The drawback of the non-refundable purchase is the lack of flexibility. The method I propose here fills the gap between these two extreme cases. Offering guests a choice of room rate–reservation fee combination appeals to travelers who are always seeking a discount or deal. With the new reservation approach, travelers can gain a discount on the overall cost of room and reservation by revealing their likelihood of travel.

⁵ Under some circumstances, the guest can change the booking for a substantial fee, but those fees are meant to prevent any further changes in reservations.

Before I turn to the description of the optimizer, let me close this section by pointing out that the reservation approach found in this tool is easy to implement for hotel managers, online travel agencies (OTAs), and other third-party intermediaries. The concept of paying a fee to gain value in conjunction with a reservation is no longer as alien as it was ten years ago. As described above, the key to the model is that the guest gains something of value (a reduced room rate) in exchange for giving the hotel manager something of value—namely, an estimate of the likelihood that the room in question will be occupied. With this knowledge, the hotel manager can determine how many reservations to accept on a particular date and reduce the chances of having to walk guests due to overbooking or, on the other hand, having unsold rooms. Furthermore, armed with a more accurate estimate of future room occupancy, hotel managers can set room rates more efficiently to meet future demand and adjust marketing and promotion activities accordingly.

Summary

To summarize, this article proposes a new reservation approach that contains the following features:

- Pricing the reservation as an option should attract travelers to use the new reservation method, because it provides a significant price discount that otherwise would not be available;
- By offering the discount, the hotel operator obtains more accurate information about the customer’s future travel probability, thereby providing additional arrival information for the revenue management system;
- Consequently, instead of using historical information on room rates and occupancies, the hotel manager now can obtain forward-looking information regarding inventory, and can adjust the room rate to increase RevPAR;
- Price integrity is improved because customers are offered a menu of reservation choices that connect a particular room rate with a non-refundable reservation fee (the traveler’s choice depends on that customer’s assessment of her or his travel probability); and
- This approach is easy to implement, since the new reservation method is an extension of commonly used reservation methods. It bridges the gap between a free reservation and a non-refundable reservation.

Below I provide a step-by-step illustration of how a hotel operator can use this tool to manage reservations and forecasts hotel revenues.

Hotel Reservation Optimizer preface screen

Hotel Reservation Optimizer	
Traveler Form	Get a quote of hotel room rate; Make a reservation; Modify a reservation.
Operator Form	Input hotel cost parameters; Determine fee schedule for reservations; Manage reservations.
Charts	Plot forecasted revenue from two sources: non-refundable reservation and room rate balance.
Booking	Booking information on guests' probability of travel and payment for certain check-in date.
Data	Pivot table for existing and reservations, room inventory and availability, revenue forecasting.

Hotel Reservation Optimizer
 [Version 1.1 November 1, 2011]
 developed by Peng Liu, Ph.D.
 485B Stalter Hall, Ithaca NY 14853
 for distribution by the
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Guide to the Hotel Reservation Optimizer

The Hotel Reservation Optimizer example given here demonstrates how travelers and hotel managers alike can benefit from a policy of expressly setting a price on the reservation in conjunction with the room price, as a function of the probability that the guest will actually occupy the room.

PREFACE SCREEN

The Hotel Reservation Optimizer has five screens, one for each of the five available functions, which are compiled into five forms using tabs in Excel. As shown in Exhibit 2, the screens provide the following functions. Screen 1, the “Traveler Form,” is designed for use by potential hotel guests. Using this tab, would-be guests can get quote of a hotel’s rate and reservation price, make a reservation, or modify an existing reservation. Screen 2, the “Operator Form,” which is designed for hotel operators or managers, allows the revenue manager to input specific hotel information such as total capacity and cost structures at different times for a particular check-in date. The tool calculates reservation prices based on these inputs. The Operator Form also can provide the estimated maximum number of reservations to be accepted for particular type of guest. The third tab, “Charts,” provides

three plots of revenue forecasts: revenue from the non-refundable reservation fee, expected revenue from the room rate balance to be paid at check-in, and the sum of the two. The “Booking” form, the fourth screen, displays all the new reservations for each check-in date kept in the system. The last form, “Data,” demonstrates pivot tables of simulated numbers of reservations. To open each form, the user can just click the tab on the left panel.

In the remainder of this report, I will explain the basis of each form, describe it in more detail, and demonstrate how to use this Excel-based hotel reservation tool. For the purposes of this illustration, I assume that the hotel is the only one with availabilities in this market. This analysis is particularly relevant for business travelers who are attending a conference or a meeting at a particular hotel.⁶ The optimizer is still applicable in a competitive hotel market, in which case, the hotel rates should reflect the hotel’s pricing power and should be dynamically adjusted.

⁶ I intentionally contrast with the assumption of Quan 2002, *op.cit.*, and Quan and Carvell 2008, *op.cit.*, who treat hotels as substantively commoditized products to highlight the existence of reservation value for travelers who are not price-sensitive.

EXHIBIT 3

Traveler form

Traveler Form

Please select the date of travel, then choose a combination of reservation fee and hotel rate payment from the fee schedule. The hotel rate balance due at the check-in is listed in the second row of fee table; the reservation fee (non-refundable) is listed in the bottom row. To determine the fee choice, you can estimate the likelihood of traveling need for a selected date. Guests with a higher travel probability choose higher non-refundable fee at the reservation (toward to the right of the fee table). The traveling probability can be updated and modified later when your business need becomes more certain.

Date: 12/30/11

Fee Schedule Provided by the Operator

	0.1%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
\$	100.00	\$ 95.00	\$ 80.00	\$ 70.00	\$ 60.00	\$ 50.00	\$ 40.00	\$ 30.00	\$ 20.00	\$ 10.00	\$ 0.00	Probability (%) Hotel Rate Reservation
\$	0	\$ 0.50	\$ 2.00	\$ 4.50	\$ 8.00	\$ 12.50	\$ 18.00	\$ 24.50	\$ 32.00	\$ 40.50	\$ 50.00	

Dec 2011 Dec 2011

Sun	Mon	Tue	Wed	Thu	Fri	Sat
27	28	29	30	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31
1	2	3	4	5	6	7

Book
Clear

Additional Reservation Fee or Refund

New Balance Due at Check-In

Modify Reservation
Confirm Modified Booking

TRAVELER FORM

The Traveler Form summarizes the mutual problem faced by the guest and the hotel with regard to whether the room will eventually be occupied, and the appropriate price for that room rental as it relates to the probability that the guest will actually make the proposed trip (Exhibit 3). The guest in this instance has in mind a particular percentage chance of actually occupying the room. The hotelier does not know that percentage, but having that knowledge would assist the hotelier immensely in setting rates and determining the number of reservations to accept for that date. The hotelier can learn that percentage likelihood by offering an array of room rates in conjunction with a set of fees based on the guest's estimate of the likelihood that she will honor the reservation. This estimated probability is revealed when the guest purchases the option to occupy the room and in so doing selects a combination of option price and room rate. When the guest elects a particular reduced room rate in conjunction with a particular cost for the reservation option, the hotel learns the guest's estimate of the likelihood that she will occupy the room, while the guest is offered a room rate that is lower than she otherwise might pay. As I indicated above, the underlying formulas are given in the *Cornell Quarterly* article, but the results are embodied in the Traveler Form.

At the top of the traveler form are brief instructions on how the guest will make the reservation. The table in the middle of the exhibit is the pricing scheme provided by hotel operator (the derivation of which I will show later in the "Operator Form"). First of all, the potential guest should

EXHIBIT 4

The confirmation window from traveler form

Please Enter Your Name and Confirm the Reservation

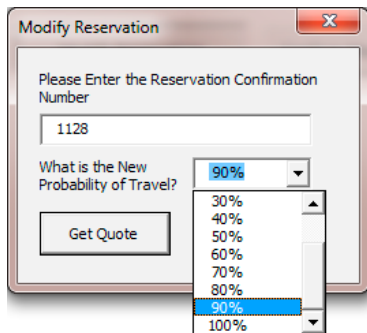
Confirm Reservation
Cancel

select an arrival or check-in date. Different dates may have different pricing for the room rate and reservation prices. For demonstration purposes, I use an arrival date of 12/30/2011. The hotel rates and reservation prices are shown in the pricing table arranged by the level of travel probabilities of the guest. The potential guest can move the table's scrollbar and select what she considers to be the ideal combination of option price and room rate.

Suppose the guest expects a 50-50 likelihood of traveling or not traveling. She would indicate her 50-percent probability of traveling by electing the highlighted price combination of a \$12.50 non-refundable fee for this reservation and a \$50 room rate (which is far less than she might otherwise pay). On the check-in date (12/30/11), if the guest makes the trip, she would pay the balance due at check-in of \$50. Therefore,

EXHIBIT 5

Reservation modification forms



Modify Reservation

Please Enter the Reservation Confirmation Number

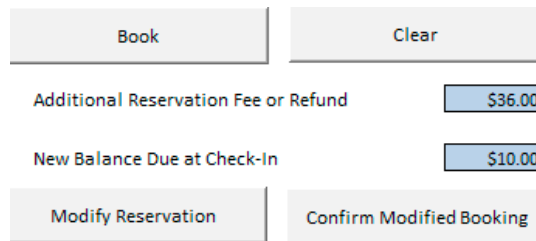
1128

What is the New Probability of Travel?

90%

30%
40%
50%
60%
70%
80%
90%
100%

Get Quote



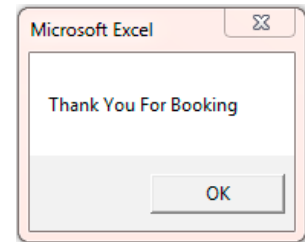
Book Clear

Additional Reservation Fee or Refund \$36.00

New Balance Due at Check-In \$10.00

Modify Reservation Confirm Modified Booking

New quotes from modified booking



Microsoft Excel

Thank You For Booking

OK

Confirmation

EXHIBIT 6

Operator form



Operator Form

Maximum number of reservations the operator can take, according to guest's probability of travel:

Unlikely

Go to Date

Dec 2011

Sun	Mon	Tue	Wed	Thu	Fri	Sat
27	28	29	30	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

Expected Revenue

Probability (%)

Booked

Reservation Fee

Balance at Check-in

Date 12/30/2011

Total Capacity

Expected Rooms Available for Selected Date

Reservations Available by Probability 20 %

Select a Date Enter Inputs Clear

40%	50%	60%	70%	80%	90%	100%
22	19	8	12	12	10	8

EXHIBIT 7

Operator inputs of hotel capacity and cost structures



Operator Inputs

Number of Rooms 100

Room Cost at t = 0 50

Room Cost at t = 1 100

Ok Cancel

the guest's total cost for this itinerary is \$62.50. By revealing her likelihood of travel by purchasing the option, she has gained a room at a reduced rate.

Once the guest has decided on the likelihood of travel based on the price of the reservation option and the room, she can press the "Book" button, and then a "Confirm Reservation" window (Exhibit 4) will pop up. Filling in the guest name and hitting "Confirm Reservation" will finish the reservation. If the guest wants to explore the price for a different date or propose a different probability of travel, she can just press "Cancel" at this point and press "Clear" to start over. If the guest subsequently determines that her likelihood of travel has changed, she can use the traveler form to change the reservation by clicking the "Modify Reservation" button. The modification window (Exhibit 5) will pop up, and the guest can retrieve the previous reservation by entering the appropriate reservation confirmation number. At this point, the guest can get a new quote by changing or updating to a new probability of travel in the drop-down menu.

An additional reservation fee and new balance due at check-in will be provided (also in Exhibit 5). If the guest

revises her traveling likelihood from 50 percent to 90 percent, she will be required to pay an additional \$36 with re-estimated balance of \$10 due at the check-in. Therefore the total cost will be \$58.50 (including \$12.50 of non-refundable fee at initial reservation, \$36 additional cost for the modified reservation) The new \$10 balance due at the check-in if she stays in the hotel is lower than the initially specified cost. The modification is completed once the guest presses the "Confirm Modified Booking" (Exhibit 5).

OPERATOR FORM

The operator form serves a key function in the hotel reservation optimizer. On this screen (Exhibit 6), the hotel operator inputs its own cost parameters and capacity constraints into the pricing scheme. This tool assists the hotelier in setting the array of rates associated with the probabilities of travel. The first step is to select a date to check the inventories. Needless to say, the hotel's rates are different on different days of the week and different months of the year. The rates are also dependent on the numbers of rooms sold. The hotel manager can change the rate for any particular date

EXHIBIT 8

Inventory, room availability and maximum number of reservations

Maximum number of reservations the operator can take, according to guest's probability of travel:

Unlikely	Less Likely	More Likely	Most Likely	Certain
1,500	583	510	236	100

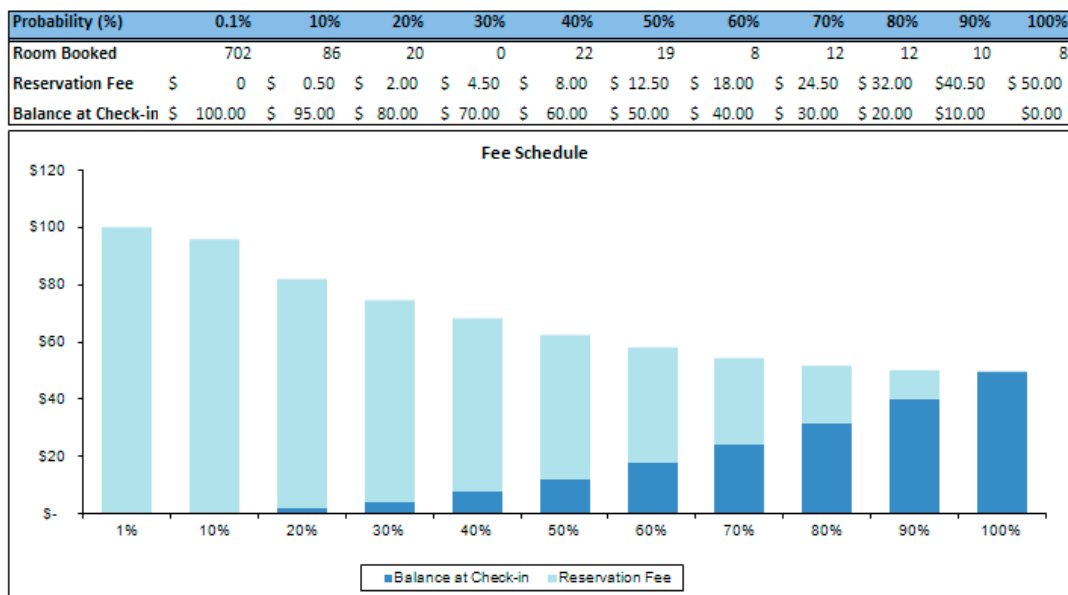
Expected Revenue: \$7,300

Date: 12/30/2011

Total Capacity	100
Expected Rooms Available for Selected Date	28
Reservations Available by Probability	20 % 140

EXHIBIT 9

Fee structure: Non-refundable reservation fee and balance at check-in



according to seasonal differences (from historical demand statistics) and inventory information (generated from this reservation tool).

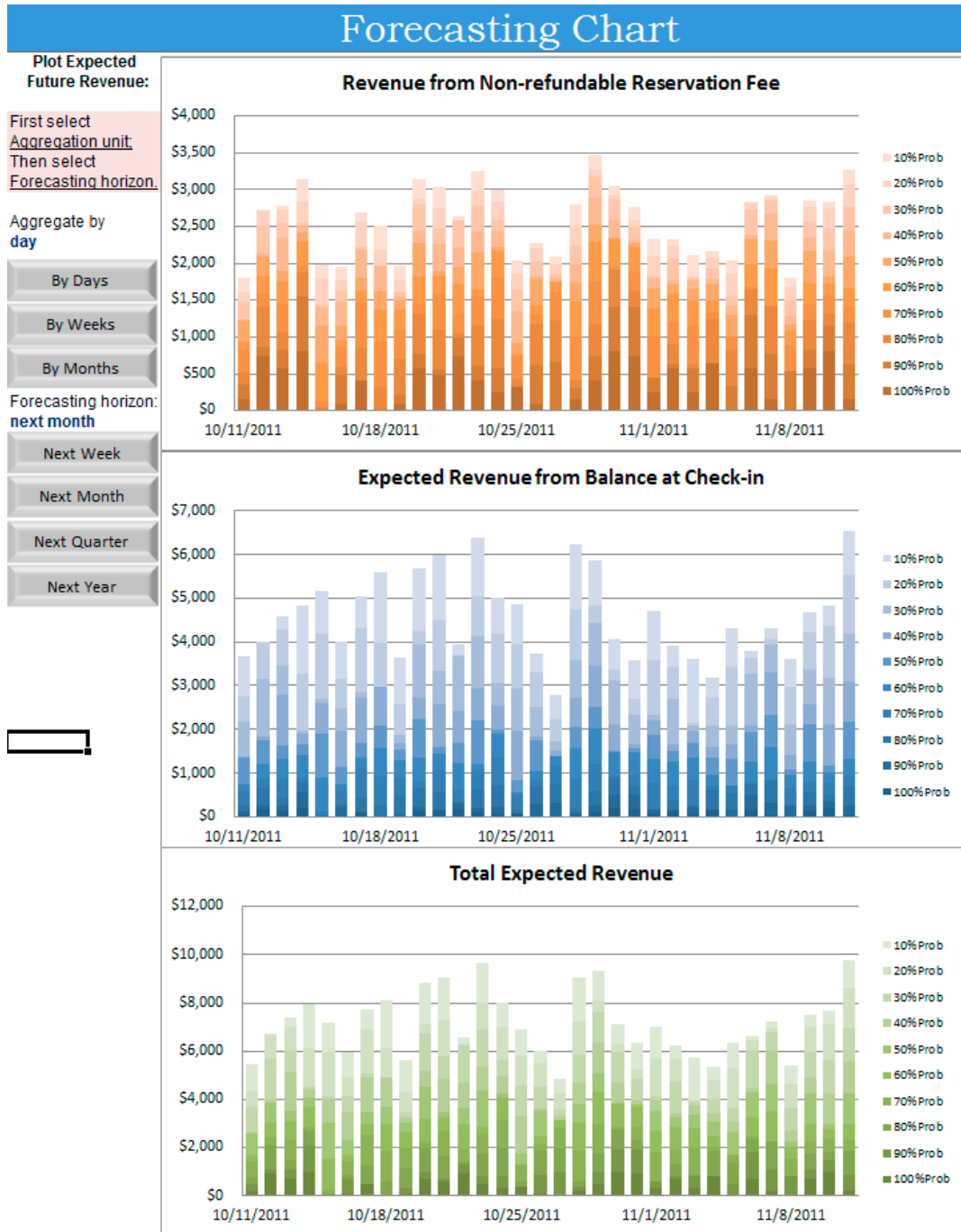
To generate the pricing scheme for reservations, the operator can input the cost parameters by using the “Enter Inputs” button (Exhibit 7). The “Operator Inputs” window allows the operator fill in total number of rooms in the hotel, that is, all rooms available for occupation. (For demonstration purposes, I use a 100-room budget hotel as an example.) “Room Cost at $t = 0$ ” is the lowest price at which you would sell the room-night (likely the prepaid non-refundable rate) and the “Room Cost at $t = 1$ ” is highest price for selling the room-night (likely the walk-in rate).

The table on the left of Exhibit 8 displays the maximum number of reservations the operator can take according to the estimated probability of guests’ likelihood of travel. At this point, this table only displays the total number of reservations allowed for an empty hotel, and any existing reservations have so far not been considered. For the “Cer-

tain” category (100% probability), the maximum number of reservations is 100, or, the total number of hotel rooms. For the “Most Likely” category (80% to 90% probability), the maximum number of reservations an operator can take is 236. The maximum number of reservations is 510 for “More Likely” (50%-70% probability); 583 for “Less Likely” (30%-40% probability); and 1,500 for “Unlikely” (0%-20% probability).

If the operator wants to take into account existing reservations, she should refer to the table on the right of Exhibit 8. It shows that for the total capacity of 100 rooms, there are 28 rooms that are available for reservation, and the hotel anticipates that 72 rooms have a high likelihood of being occupied for the selected date. The tool then shows the operator the maximum number of reservations she can take for a specific guest-travel probability. For example for guests with 20-percent travel probability, she can take at most 140 new reservations (based on the low likelihood that those guests will actually travel).

Forecasting charts



The fee structure that eventually appears on the Traveler Form is laid out according to the hotel's cost parameters. Once again, the fee structure shown in Exhibit 9 consists of two parts: a non-refundable reservation fee and the balance due on the room rental on the check-in date. The graph shows how the reservation fee increases with the travel

probability, while at the same time the balance amount at check-in decreases with the travel probability. The fee structure is designed such that each potential guest will select the fees that reflect her true travel probability. For example, it is extremely unlikely that a guest with a 20-percent probability will mimic a 90-percent travel probability simply to get the

EXHIBIT 11

Booking information

Bookings								
Check-in Date	Guest Name	Confirmation	Prob 1	Prob 2	Res Fee1	Balance 1	Res Fee2	Balance 2
08/30/11	Adam	1362	30%		6.13	65		
08/31/11	PL	1873	70%	10%	\$6.05	\$18.00	(\$4.80)	\$30.00
09/01/11	Jenny	1473	20%	90%	\$4.50	\$70.00	\$16.63	\$35.00
09/23/11	Eaton Lebet	1002	20%		\$4.50	\$70.00		
09/30/11	Ben	1203	70%	50%	\$15.13	\$45.00	(\$8.88)	\$50.00
10/01/11	Yi	1841	40%		\$8.00	\$60.00		

EXHIBIT 12

Data and pivot table used in the hotel reservation tool demonstration

Preface										
Bookings (Existing)										
Bookings (New)										
Availability										
Revenue by Reservation Fee										
Description	Sum of 1%	Sum of 10%	Sum of 20%	Sum of 30%	Sum of 40%	Sum of 50%	Sum of 60%	Sum of 70%	Sum of 80%	Sum of 90%
Date	Sum of 1%	Sum of 10%	Sum of 20%	Sum of 30%	Sum of 40%	Sum of 50%	Sum of 60%	Sum of 70%	Sum of 80%	Sum of 90%
9/29/2011	641	57	19	20	1	12	3	7		
9/30/2011	827	1	28	33	2	11	7	4		
10/1/2011	524	19	28	17	25	6	9	9		
10/2/2011	224	95	44	2	5	5	10	2		
10/3/2011	569	60	50	3	15	20	15	2		
10/4/2011	874	53	22	13	18	8	3	6		
10/5/2011	539	43	50	3	22	7	5	14		
10/6/2011	249	99	34	0	19	10	13	14		
10/7/2011	482	66	23	5	3	5	8	9		
10/8/2011	621	87	10	31	10	18	11	3		
10/9/2011	647	90	40	19	21	3	7	11		

low room rate of \$10 (instead of \$80), because she will have to pay a reservation fee of \$40.50 to get that rate, and the fee will not be refunded if the trip does not materialize.

FORECASTING CHARTS

The “Forecasting Charts” form shows a plot of the forecasted revenue. The operator should first select an aggregation unit (by day, by week, or by month) then select a forecasting horizon for the next year (or quarter, or month, or week). As long as the forecasting horizon is greater than the aggregation unit, three plots will be generated to show future revenues. The top panel of the Exhibit 10 shows the revenue from non-refundable reservation fees. The middle panel of the Exhibit 10 displays the expected revenue from the balance at check-in. The bottom panel of the Exhibit 10 is the total expected revenue from the two sources. At each plot, the shade of the bar shows the level of certainty of the

reservations. The darkest portion (at the bottom of each bar) indicates that the revenue comes from the reservations with a higher travel probability.

BOOKINGS

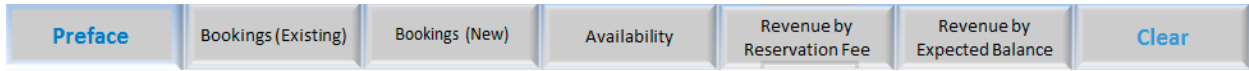
The “Bookings” form records the new reservations made via this system. For each future check-in date, the “Bookings” form (Exhibit 11) records the guest’s name and confirmation number, as well as the traveling probability indicated by the guest (Prob1), the non-refundable reservation fee, and the balance due at check-in. If a reservation is subsequently modified, the updated probability (Prob2) and corresponding fees will be added to this form.

DATA

The “data” tab stores and can visualize the data, as checked in the pivot table on the right side of Exhibit 12.

EXHIBIT 13

Data form's seven buttons



The hotel manager can press any of the seven buttons on the top of the table (Exhibit 13) to see the data in the desired format. “Bookings (Existing)” reports all the data on existing (previous generated) reservations. “Bookings (New)” shows all data on new reservations using this tool. “Availability” displays the maximum number of reservations the manager can take for a particular travel probability for each date. Similarly, the “Revenue by Reservation Fee” and “Revenue by Expected Balance” summarize those two sources of revenues for a particular check-in date. The pivot table field list provides more flexibility for manager to select any particular combination of data to display. The “Clear” button clears the field, while the “Preface” leads to the first tab.

SUMMARY

In this report, I have explained how this spreadsheet-based Hotel Reservation Optimizer can help hotel operators to manage hotel reservations based on the guests’ declaration of their travel probability through the purchase of an option for a particular room rate. To demonstrate the use of this tool, I have used simulations to fill in past reservations. Each hotel may use this tool to develop its own cost structure and experience in understanding market demand. The useful feature of this reservation tool is that each reservation now contains valuable information regarding the likelihood that the guest will actually check in. This information can be used to better manage hotel inventories, create promotions (and marketing), and especially set the room rate. ■

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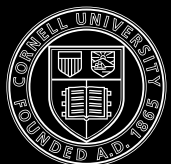
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