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Traveler Booking Windows and Revenue Management Forecasting

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Booking Windows and Revenue Management

One of the most challenging elements of revenue management is anticipating consumer behavior to make optimal decisions. Trip planning activities can be unpredictable, vary by segment, and can be dynamic over time. In the early applications of revenue management, airlines and hotels utilized booking limits to increase prices as the date of stay neared. These industries recognized a time-based booking structure where leisure travelers booked well in advance, while business travelers booked closer to the date of stay (Webb, 2016). While leisure travelers could book last minute, travel planning was difficult because inventory availability was unknown, and reservations were made through travel agents or directly with service providers. Ultimately, this segmentation, combined with time-based price discrimination, greatly contributed to the success of early revenue management strategies.

Today, hotels face a much different booking environment. In the last decade, online travel agents (OTAs) emerged as an industry disruptor. These channels revealed hotel availability and prices to consumers at any time. Furthermore, the channels allowed travelers to make reservations on their own. The new booking structure provided flexibility, while also contributing to what has been termed the “deal-seeking culture.” This is when travelers scour various reservation sites in search of the best deal, and choose to book at a time they perceive to be optimal (Schwartz & Chen, 2012). Many

have attributed this change in booking behavior to have shrunk the booking window. That is, customers book closer to the date of stay. From a segmentation perspective, the original time-based scheme becomes less viable as leisure travelers have a straightforward approach to book up until the date of stay. The evolution has continued as mobile applications make travel planning even easier, allowing users to book accommodation even after arriving at the destination.

While the emergence of OTAs created noticeable shifts in booking behavior, booking windows fluctuate less drastically due to a variety of circumstances. From a macro perspective, economic conditions such as unemployment and exchange rates may influence traveler confidence regarding when to book a trip. At the same time, micro factors such as the announcement of local events, new competitors, marketing promotions or other activities may alter the rate of booking. Industry sources frequently report booking window shifts and suggest that fluctuations are not one-sided, that is booking windows may grow or shrink. For instance, David Sangree, president of Hotel & Leisure Advisors stated, “The booking window for groups is decreasing as many group bookings are being done in a shorter timeline than historically” (Koss-Feder, 2019). Similarly, Weinsheimer (2015) found that while “the path-to-purchase, from first search to final booking, is lengthening,” the “booking lead times” are “getting shorter.” Conversely, Denihan Hospitality EVP Tom Botts was quoted affirming that the average booking window increased to 39 days compared to 35 the previous year (Worgull, 2013), and Pleasant Holidays president and CEO Jack Richards noted an increase in 10% of vacations booked more than 151 days in advance (Clausing, 2019).

While booking window shifts appear to be evident, the COVID-19 pandemic dramatically altered booking windows due to safety concerns (Farr, 2020) and travel restrictions in more than 200 countries (Lee, 2020). The dynamic nature of the pandemic caused a shock in booking behavior with lead times shrinking to unprecedented levels. For example, in June 2020, 65% of Hyatt’s bookings were made only four days in advance (Oliver, 2020). The CEO referred to the phenomena as “the shortest transient booking window the company has ever seen” (Oliver, 2020). Similarly, in August 2019, Accor reported that 60% of European bookings were made only five days in advance (Fox, 2020). It’s no surprise that macro-level shocks such as COVID-19 can greatly influence travel planning and revenue managers will continue to observe shifts in the near future as travel restrictions and virus concerns remain in flux.

Forecasting with Dynamic Booking Windows

As booking behavior has evolved, the revenue management profession has been forced to adapt. All revenue management decisions begin with a forecast and quantitative forecasts are dependent on the data used in estimation. These include both historical

rooms sold and reservations on-the-books (OTB) for past and future dates. A variety of techniques can be employed depending on which data points are used in the estimation process. For instance, OTBs reservations can be used to project current reservations to the date of stay with pick-up methods such as regression, while historical room sales may be estimated with time-series techniques. Furthermore, new techniques such as neural networks have the ability to combine various data points together into one model.

While a variety of forecasting approaches have been tested and continue to evolve, it is important to recognize that all forecasts are dependent on the data. When travelers change their booking behavior, the underlying data structure that was used during estimation also changes. In other words, the historical patterns that were identified by the models to produce accurate forecasts may no longer be valid. If the algorithms are not updated to reflect the new booking environment, accuracy may decline contributing to less optimal rate recommendations and other revenue management decisions.

Let's consider a simple example. In Figure 1, a historical booking curve for a 100-room hotel is shown with the solid green line. On this date, a total of 86 rooms are sold. If we were projecting a forecast one month in advance (30 day horizon), we would know that 52 rooms had already been reserved. Assuming perfect information, we could utilize a pick-up factor of 34 rooms to obtain a perfect forecast of 86 (52 + 34 = 86). However, what if the booking behavior changed, and we were still applying the same pick-up factor (34 rooms)? The two dotted lines represent an expansion of the booking window with reservations occurring earlier. The two dashed lines represent late-booking behavior or a shrunken booking window. Utilizing the same pick-up factor of 34 rooms and the corresponding reservations OTBs for each of these curves, we calculate the new forecasts as shown in Table 1. The errors change drastically as the windows expand or contract based on the size of the shift. It is important to note that in every instance, 86 rooms are sold. The only thing that has changed is when the traveler has chosen to book the reservation.

Figure 1 – Example of Booking Window Shifts

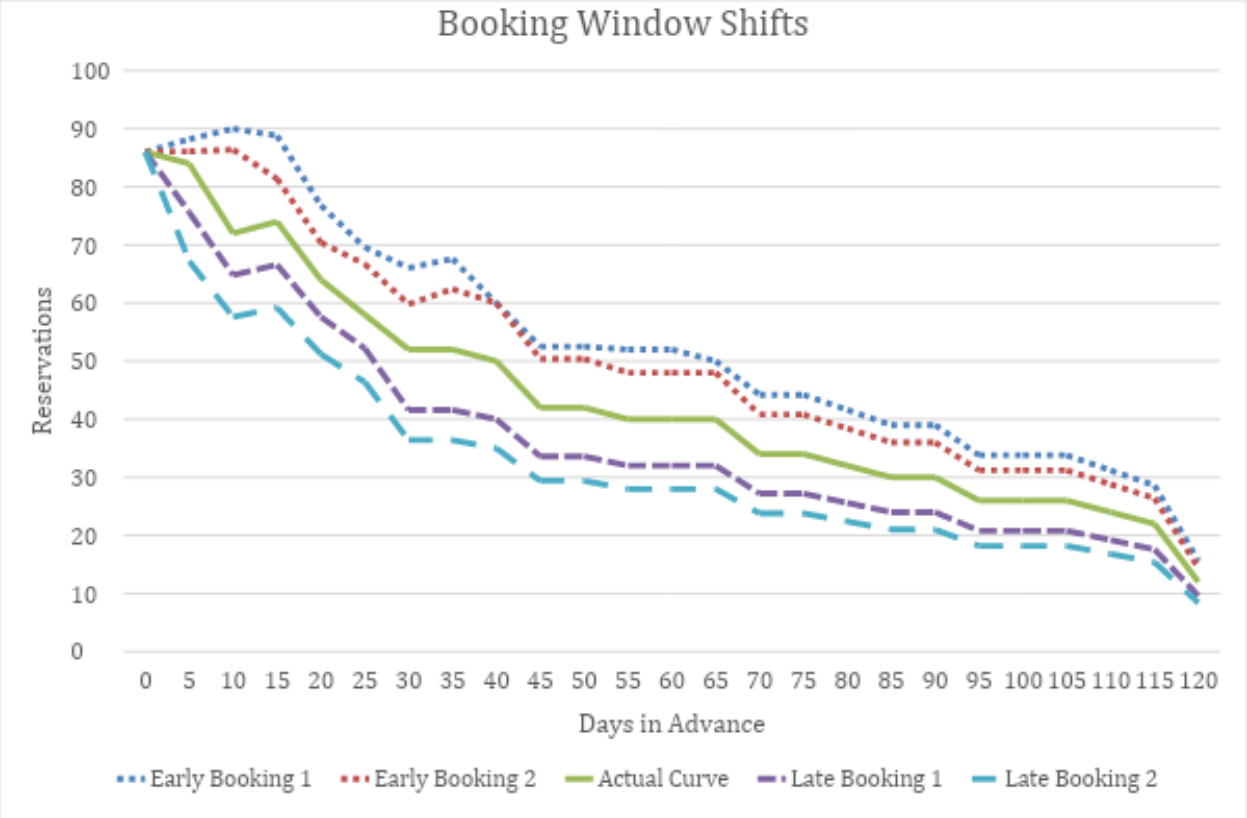

Table 1 – Forecast Performance

Booking Curve	OTB 30	Pick Up Factor	Forecast	Actual	Error	Percent Error
Early Booking 1	66	34	100	86	14	16.3%
Early Booking 2	60	34	94	86	8	9.1%
Actual Curve	52	34	86	86	0	0.0%
Late Booking 1	42	34	76	86	10	12.1%
Late Booking 2	36	34	70	86	16	18.1%

What can revenue managers do to combat booking window shifts that jeopardize forecasting accuracy? The forecasting techniques that utilize OTBs information to predict future demand can be categorized into two groups. In the first group, the total reservations on-the-books can be extrapolated into the future by adjusting the current reservations OTBs by some factor as shown in the example. In this instance, the forecaster is operating under the assumption of the Markov property which states that given the present, the future does not depend on the past. In other words, the forecast assumes that prior reservations have no impact on future reservations over the remainder of the booking window.

In the second group, data points depicting how reservations accumulate are utilized in forecast estimation. Tse and Poon (2015) argue that reservation lead time is a good representation of the various macro and micro factors that affect room occupancy and may carry through the entire booking period. In other words, the pace of booking may provide valuable insights regarding the actual number of rooms that will be sold and should be utilized in the forecasting process. Recent work by Lee (2018) empirically investigated this and found that early reservations may help predict future bookings to come. Furthermore, the study by Webb et al., (2020) estimated and tested a number of advanced-reservation forecasting techniques in both categories. These same forecasting models were then retested, years later after each of the properties booking windows had shifted. When comparing the results across time periods, the forecasting errors were less likely to deteriorate when the booking curve was utilized in the prediction. In other words, forecasting errors were more stable when the model used the pace of booking as an input. The results of these studies suggest that the accumulation of bookings is important and may assist revenue managers in developing models that are resilient to changes in traveler booking behavior.

Conclusion

Ultimately, booking windows are in constant flux due to a variety of factors that may impact hotel demand and the pace of booking. These shifts present various challenges for revenue managers with regards to forecasting and pricing. From a forecasting perspective, it is critical for revenue managers to monitor accuracy as booking windows shift. While sudden changes in behavior due to events such as COVID-19 are unique, smaller shifts are ever present and may cause accuracy to deteriorate. Prior research suggests that incorporating data points depicting the pace of booking may generate models that are more resilient to these shifts. That is, the forecasting accuracy may be more stable over time. The success of this approach may be attributed to how the timing of reservations help to depict the current consumption climate, as well as many of the other factors that influence demand. Incorporating this information allows algorithms to make predictions based on historical reservations that follow similar patterns of the past. Furthermore, techniques that utilize this data may not need to be re-estimated as often, thus providing a more autonomous forecasting system. As forecasting is the first step in the revenue management process, sustained accuracy will likely lead to better decisions, generating superior performance over time!

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