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Hotel overbooking taxonomy: Who and how?

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ABSTRACT

The main objective of this research note is to explore the current landscape of hotel overbooking practices and describe the types of overbooking methods used. Among several interesting findings, key are that a large number of hotels do not overbook and for those that do, the theoretically superior risk-based method of setting overbooking limits is not widely used. These and other findings help provide a fuller picture of the state of hotel overbooking practices and should lead to a multitude of research projects given the many questions raised.

1. Background

Overbooking is the cornerstone of revenue management wherein hotels reserve rooms in excess of their capacity (overbook) primarily to counter revenue losses associated with cancellations, no shows, and early departures (Klophaus and Pölt, 2007; Phillips, 2005; Riasi et al., 2018; Rothstein, 1974; Toh et al., 2005). The extant research is rich with studies that show how to improve overbooking practices by exploring inventory management, room allocation, and booking level optimization (Baker and Collier, 1999; Bitran and Gilbert, 1996; Corney, 1984; Ivanov, 2006, 2007, 2015; Karaesmen and van Ryzin, 2004; Koide and Ishii, 2005; Lan, 2009; Phumchusri and Maneesophon, 2014; Toh and Dekay, 2002; Williams, 1977). The research literature also highlights concerns about overbooking (Krawczyk et al., 2016) such as its legality (Enghagen, 1996), its impact on customer satisfaction and loyalty (Capiez and Kaya, 2004; Guo et al., 2016; Hwang and Wen, 2009; McCollough, 2000; Noone and Lee, 2011; Sparks and Fredline, 2007; Wirtz et al., 2003), the long-term effects on demand and profitability (Corney, 1984; Lefever, 1988), and the compensation of walked guests (Badinelli, 2000; Hwang and Wen, 2009; Lefever, 1988; Noone and Lee, 2011; Salomon, 2000). The ultimate goal of overbooking is to optimize revenues and profits (Hwang and Wen, 2009). In this regard, hotels are incentivized to overbook even when penalties fully cover their losses from cancellation and no shows, because it serves as an opportunity to maximize capacity utilization. From this realization emerges a critical question, which is, “How many rooms should a hotel overbook?” (Hadjinicola and Panayi, 1997).

Phillips (2005) discusses four generic overbooking objective functions (methods) which revenue managers use:

1.1. Deterministic heuristic

The booking limit (i.e., maximum number of overbooked rooms) is calculated by dividing the capacity by the historical show rate.

1.2. Risk-based

this probability based booking limit is determined such that the expected revenue after deducting the expected cost of denied service, is maximized.

1.3. Service-level

Revenue manager determines the highest booking limit such that denied-service incidents will not exceed the managerial expectations.

1.4. Hybrid policy

Revenue manager calculates both risk-based and service-level booking limits and then selects the minimum of the two as the optimal booking limit.

There are additional theoretical models that are not commonly practiced in the lodging industry such as the Markovian decision process, and the simulation approach (see Lambert et al., 1989; Lee et al., 2013; Liberman and Yechiali, 1978; Rothstein, 1974, 1985; Suzuki, 2006).

From a theoretical perspective, Phillips (2005)’s four methods listed above differ in computational complexity and in their potential to generate the highest revenue. A hotel’s selection of the appropriate

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overbooking method and its overbooking frequency depends on factors such as data availability, forecasting ability, degree of competition, demand structure, various firm characteristics, and the firm's service philosophy. Accordingly, we hypothesize that:

H1. *A hotel's selection of an overbooking approach depends on its characteristics*

H2. *A hotel's overbooking frequency depends on its characteristics*

The main objective of this study is to explore the current landscape of hotel overbooking practices and to provide new empirical evidence on how hotels overbook. In the sections that follow, this research note outlines the extent to which the four generic overbooking methods are being implemented. The study contributes to the revenue management literature by providing empirical evidence that hotels considerably differ in how they approach overbooking. Furthermore, the study shows that despite the advantages of risk-based overbooking approach, the majority of hotels follow deterministic overbooking.

2. Methods

2.1. Data

A survey on overbooking practices was emailed (December 2017 and February 2018) to 10,000 US hotels using email addresses provided by Smith Travel Research (STR). After discounting bounced back, and other unusable email addresses, the 377 usable responses out of 8568 (that did not bounce back) represent a useable response rate of approximately 4.4%. Responses were coded and anonymized, and then merged with information provided by STR about the responding hotel properties.

2.2. Variables

Table 1 displays the list of variables that were recorded using responses from the surveys. In addition to these variables, STR provided information about hotel location (urban, suburban, airport, interstate/motorway, resort, small metro/town), size (in terms of number of rooms), operation (chain owned/managed franchised, independent), and class (luxury, upper upscale, upscale, upper midscale, midscale, economy).

2.3. Sample characteristics

The majority (90%) of the 377 sampled hotels were franchised, and 42% were from the upper-midscale category. Upscale (20%) and midscale hotels (18%) made up for the second and the third largest in numbers of hotels in the sample. In terms of hotel size, 84% of the hotels had fewer than 149 rooms, and only 2% of the hotels had more than 300 rooms. A majority (41%) of hotels were from the suburbs and the metropolitan market. The second largest category (23%) with regard to location was the small metropolitan market, which comprises towns that have less than 150,000 people, with resort hotels accounting for 4% of the sample. Finally, more than two thirds (69%) of survey respondents were hotel general managers. Detailed sample characteristics are shown in Table 2.

Table 2
Sample Characteristics (N = 377).

Property Characteristics	Values	Frequency	Percent
Operation	Chain Owned and/or Managed	20	5.3%
	Franchised	340	90.2%
	Independent	17	4.5%
Location	Urban	38	10.1%
	Suburban	156	41.4%
	Airport	19	5.0%
	Interstate/Motorway	62	16.4%
	Resort	15	4.0%
	Small Metro/Town	87	23.1%
Size	Less than 75 Rooms	107	28.4%
	75-149 Rooms	209	55.4%
	150-299 Rooms	52	13.8%
	300-500 Rooms	8	2.1%
	Greater than 500 Rooms	1	0.3%
Class	Luxury	7	1.9%
	Upper Upscale	26	6.9%
	Upscale	76	20.2%
	Upper Midscale	158	41.9%
	Midscale	67	17.8%
	Economy	43	11.4%
Respondent Job Title	General Manager	141	68.8%
	Reservations Manager, Rooms Director, Accommodations/Front Office Manager	12	5.9%
	Revenue Manager	9	4.4%
	Sales Manager, Group Manager	20	9.8%
	Other	23	11.2%

3. Findings

One third (36%) of the responding hotels reported that they never overbook. Chi-square independence test was used to study the relationship between overbooking frequency and hotel characteristics. Results showed that overbooking frequency is independent ($p > 0.05$) of hotel operation type (chain, independent or franchised). However, it was found that overbooking frequency depends ($p <= 0.05$) on hotel class (luxury, economy, etc.), property size and location; therefore, providing support for H2. Results indicated that larger capacity hotels, hotels located in an urban market or near an airport, and upscale or upper upscale hotels are more likely to overbook. Table 3 cross-tabulates the hotels that do overbook with the hotels' characteristics.

Table 4 provides detailed information on the state of overbooking practices. Of the overbooking hotels, 39% do so an average of 1–5 days a month, while 5% report that, on average, they overbook more than 20 days a month. We find that approximately a third of the hotels overbook more on weekdays, a third overbook more on the weekend and about a third indicate no difference. A majority (68%) report never overbooking over 5% of the hotel's capacity, while only 4% of the hotels overbook more than 10% of their capacity.

Most overbooking hotels (88%) report a dynamic approach, i.e., they adjust their overbooking limits in response to observed changes in the patterns of customer reservations, cancellations and no shows, while 12% report having a static (non-responsive) approach.

Finally, 61% of the overbooking hotels indicate using the deterministic overbooking method, meaning that they determine their optimal

Table 1
Variables.

Variable	Levels
Overbooking Frequency	Never overbooks, 1-5, 6-10, 11-20, or over 20 days a month
Most common overbooking part of the week	Weekdays, weekends, no difference between weekdays and weekends overbooking
Overbooking as percentage of the hotel's capacity (daily)	Less than 5%, 5-10%, over 10% of the hotel's capacity
Overbooking dynamicity	Static, dynamic
Overbooking Approach	Deterministic, risk-based, service-level, hybrid, other

Table 3
Overbooking Frequencies (N = 377).

Property Characteristics	% of Hotels that Overbook
Chain Owned and/or Managed	70%
Franchised	64%
Independent	53%
Urban	89%
Suburban	67%
Airport	89%
Interstate/Motorway	45%
Resort	73%
Small Metro/Town	54%
Less than 75 Rooms	41%
75-149 Rooms	69%
150-299 Rooms	87%
300-500 Rooms	88%
Greater than 500 Rooms	100%
Luxury	57%
Upper Upscale	85%
Upscale	91%
Upper Midscale	64%
Midscale	43%
Economy	40%

Table 4
State of overbooking policies in the US hotel industry.

Overbooking Policy Elements		Percent
Overbooking Frequency	Never overbooks	36%
	1-5 days a month	39%
	6-10 days a month	15%
	11-20 days a month	5%
	Over 20 days a month	5%
Most common overbooking period	No difference between weekdays and weekends	31%
	Weekdays	34%
	Weekends	35%
Overbooking daily limit	Less than 5% of capacity	68%
	5-10% of capacity	27%
	Over 10% of capacity	4%
Overbooking Dynamicity	Static	12%
	Dynamic	88%
Overbooking method	Deterministic	61%
	Risk Based	30%
	Service Level	4%
	Hybrid	1%
	Other	4%

overbooking limit by simply dividing the hotel capacity by the average historical show rate. In second place (30% of the hotels) is the risk-based method where an optimal overbooking limit is calculated by considering demand distributions, expected revenues and expected overbooking expenses – typically by using a computer software. Finally, a very small number of hotels use the service-level method (4%), the hybrid method (1%) or another unspecified method (4%).

Chi-square independence test was performed on the hotels that overbooked at least once a month to find out whether hotels' overbooking methods are related with their characteristics. It was found that a hotel's overbooking approach is independent ($p > 0.05$) of its operation type, size and class. However, it was found that overbooking approach depends on the hotel location ($p = 0.04$); therefore, providing support for H1.

4. Conclusions

This study is motivated by the need to better understand overbooking and to design more efficient overbooking methods. We provide a somewhat encouraging snapshot of the current status of overbooking practices by US hotels as we find that about two thirds of US hotels and that almost 90% of the overbooking hotels do it dynamically. However, we also found that overbooking hotels differ considerably in how they approach this task. The study shows that hotels vary in their inclination to overbook, the frequency of overbooking, the timing and the intensity of the practice, and perhaps most interestingly, they differ in the method or algorithm they use to determine their overbooking limit.

It was shown that overbooking approach depends on the hotel location. This is not surprising because a hotel's location is an important determinant of its customer base and demand structure which are both important factors when it comes to selecting an optimal overbooking policy. Moreover, results showed that overbooking frequency is related to hotel characteristics such as property size, location and class. In particular, larger capacity hotels, hotels located in an urban market or near an airport, and upscale or upper upscale hotels are more likely to overbook

Finally, we found that most hotels employ the deterministic model. This is surprising and somewhat disappointing because the deterministic model is rather simplistic and, theoretically speaking, it is much less likely to optimize overbooking levels compared to the risk-based method.

5. Future research

Given our counterintuitive finding that most hotels are not using the theoretically-superior risk-based overbooking method, an interesting question for future research is to explore the relation between the method used and performance. In other words, does this risk-based method indeed generate the highest revenues for the overbooking hotels as predicted by the theory or are the hotels doing the "right thing" by not using it? Or more generally, is there a connection between the overbooking method's complexity level and effectiveness? Furthermore, since some overbooking policies require more data to be implemented correctly, future research could investigate the relationship between data availability and overbooking strategies. There is also the possible connection to cancellation policies. Does the intuitive thought that stricter cancellation policies should reduce overbooking limits have support in the reality of hotels operations? Future research could compare the way in which US hotels overbook (as described in this study) with overbooking practices of hotels in other countries. Do cultural forces and local practices impact the overbooking practices? Finally, future studies could model the probability of overbooking using probit/logit models along with other contingent variables.

References

Badinelli, R., 2000. An optimal, dynamic policy for hotel yield management. Eur. J. Oper. Res. 121 (3), 476–503.
Baker, T.K., Collier, D.A., 1999. A comparative revenue analysis of hotel yield management heuristics. Decis. Sci. 30 (1), 239–263.
Bitran, G.R., Gilbert, S.M., 1996. Managing hotel reservations with uncertain arrivals. Oper. Res. 44 (1), 35–49.
Capiez, A., Kaya, A., 2004. Yield management and performance in the hotel industry. J. Travel Tour. Mark. 16 (4), 21–31.
Corney, W.J., 1984. The use of computer spreadsheets for overbooking optimization and analysis. Int. J. Hosp. Manag. 3 (4), 153–157.
Enghagen, L.K., 1996. The case against overbooking. J. Hosp. Leis. Mark. 4 (1), 51–62.
Guo, X., Dong, Y., Ling, L., 2016. Customer perspective on overbooking: The failure of customers to enjoy their reserved services, accidental or intended? J. Air Transp. Manage. 53 (6), 65–72.
Hadjinicola, G.C., Panayi, C., 1997. The overbooking problem in hotels with multiple tour-operators. Int. J. Oper. Prod. Manage. 17 (9), 874–885.
Hwang, J., Wen, L., 2009. The effect of perceived fairness toward hotel overbooking and compensation practices on customer loyalty. Int. J. Contemp. Hosp. Manage. 21 (6), 659–675.
Ivanov, S., 2006. Management of overbookings in the hotel industry – basic concepts and practical challenges. Tour. Today 6 (3), 19–32.
Ivanov, S., 2007. Dynamic overbooking limits for guaranteed and nonguaranteed hotel reservations. Tour. Today 7 (3), 100–108.
Ivanov, S.H., 2015. Optimal overbooking limits for a hotel with three room types and with upgrade and downgrade constraints. Tour. Econ. 21 (1), 223–240.
Karaesmen, I., van Ryzin, G., 2004. Overbooking with substitutable inventory classes. Oper. Res. 52 (1), 83–104.
Klophaus, R., Pölt, S., 2007. Airline overbooking with dynamic spoilage costs. J. Revenue

Pricing Manage. 6 (1), 9–18.
Koide, T., Ishii, H., 2005. The hotel yield management with two types of room prices, overbooking and cancellations. Int. J. Prod. Econ. 93 (1), 417–428.
Krawczyk, M., Webb, T., Schwartz, Z., Uysal, M., 2016. Overbooking research in the lodging industry: from origins in airlines to what lies ahead. In: Uysal, M., Schwartz, Z., Sirakaya-Turk, E. (Eds.), Management Science in Hospitality and Tourism: Theory, Practice, and Applications. Apple Academic Press, Oakville, Canada, pp. pp. 251–268.
Lambert, C.U., Lambert, J.M., Cullen, T.P., 1989. The overbooking question: a simulation. Cornell Hotel Restaur. Adm. Q. 30 (2), 14–20.
Lan, Y., 2009. Robust Revenue Management With Limited Information: Theory and Experiments (Doctoral dissertation). Retrieved online from. http://drum.lib.umd.edu/handle/1903/9606on4/6/2017.
Lee, S., Min, D., Ryu, J.H., Yih, Y., 2013. A simulation study of appointment scheduling in outpatient clinics: open access and overbooking. Simulation 89 (12), 1459–1473.
Lefever, M.M., 1988. The gentle art of overbooking. Cornell Hotel Restaur. Adm. Q. 29 (3), 7–8.
Liberman, V., Yechiali, U., 1978. On the hotel overbooking problem - an inventory system with stochastic cancellations. Manage. Sci. 24 (11), 1117–1126.
McCollough, M.A., 2000. The effect of perceived justice and attributions regarding service failure and recovery on post-recovery customer satisfaction and service quality attitudes. J. Hosp. Tour. Res. 24 (4), 423–447.
Noone, B.M., Lee, C.H., 2011. Hotel overbooking: the effect of overcompensation on customers' reactions to denied service. J. Hosp. Tour. Res. 35 (3), 334–357.
Phillips, R.L., 2005. Pricing and Revenue Optimization. Stanford University Press, Stanford, CA.
Phumchusri, N., Maneesophon, P., 2014. Optimal overbooking decision for hotel rooms revenue management. J. Hosp. Tour. Technol. 5 (3), 261–277.
Riasi, A., Schwartz, Z., Chen, C.C., 2018. A proposition-based theorizing approach to hotel cancellation practices research. Int. J. Contemp. Hosp. Manage. 30 (11), 3211–3228.
Rothstein, M., 1974. Hotel overbooking as a Markovian sequential decision process. Decis. Sci. 5 (3), 389–404.
Rothstein, M., 1985. OR and the airline overbooking problem. Oper. Res. 33 (2), 237–248.
Salomon, A., 2000. Overbooking: Hotels Talk the Talk to Avoid the Walk. Retrieved online from http://www.hotelinteractive.com/article.aspx?articleID=626 on 4/11/2017. .
Sparks, B., Fredline, L., 2007. Providing an explanation for service failure: context, content, and customer responses. J. Hosp. Tour. Res. 31 (2), 241–260.
Suzuki, Y., 2006. The net benefit of airline overbooking. Transp. Res. Part E Logist. Transp. Rev. 42 (1), 1–19.
Toh, R.S., Dekay, F., 2002. Hotel room-inventory management: an overbooking model. Cornell Hotel Restaur. Adm. Q. 43 (4), 79–90.
Toh, R.S., Rivers, M.J., Ling, T.W., 2005. Room occupancies: cruise lines out-do the hotels. Int. J. Hosp. Manag. 24 (1), 121–135.
Williams, F.E., 1977. Decision theory and the innkeeper: an approach for setting hotel reservation policy. Interfaces 7 (4), 18–30.
Wirtz, J., Kimes, S.E., Theng, J.H.P., Patterson, P., 2003. Revenue management: resolving potential customer conflicts. J. Revenue Pricing Manage. 2 (3), 216–226.