

Research on Hotel Room Pricing and Cancellation Policy Strategies Based on Consumer Cancellation Behavior

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Abstract: Based on the unbooking behavior of consumers, a single-channel supply chain model of a single hotel is constructed, and the room demand of a hotel is constructed by combining the consumer utility theory. The profit and room pricing of hotels with different unbooking strategies are analyzed, as well as the selection of unbooking strategies. Studies have shown that hotel room prices always increase with the increase of cancellation losses. In the strategy of allowing cancellation, the demand of hotel rooms decreases with the increase of cancellation loss. In the policy of not allowing unbooking, the greater the loss of unbooking, the greater the demand for hotel rooms. In the no-cancellation policy, the demand for rooms decreases as the reputational damage of the hotel increases. The total profit of the hotel is affected by the matching degree of rooms, cancellation loss and reputation loss of the hotel, and these factors determine the choice of the unbooking strategy of the hotel. When the hotel specifically understands the reputation loss caused by the unbooking strategy, there are corresponding thresholds for and , so that the hotel can develop the unbooking strategy with the best profit.

Keywords: Consumer Cancellation Behavior; Cancellation Strategy; Supply Chain in Hotel; Room Pricing.

1. Introduction

According to the data of the National Bureau of Statistics, in terms of tourism consumption, the annual domestic travel of 4.89 billion people in 2023, an increase of 93.3% over the previous year [1]. With the rapid recovery of the social economy, the consumption demand of the people also increases, and the service consumption grows rapidly, and the tourism industry shows a good recovery trend. The new growth of the tourism industry has brought new revenue flows to the hospitality industry, which has borne the brunt, but it has also brought many new problems. Such as the irrationality of consumers caused by large room demand variability, and high cancellation probability, in the face of this type of consumer group, hotels must choose appropriate strategies to reduce their own losses.

For small and medium-sized hotel enterprises, in the face of traditional OTA channels, such as Ctrip, Meituan, Feizhu, and other online platforms, which monopolize the flow of the liquor travel market, direct hotel channels have been unable to occupy a favorable position in the supply chain[2]. In this type of power structure, how should the hotel enterprises deal with the unsubscription behavior of consumers? For the hotel side, how to price and develop what cancellation strategy to achieve higher revenue? This study will build a single-channel supply chain model from the perspective of small and medium-sized hotel enterprises, and analyze the factors affecting hotel room pricing and unbooking strategy selection in combination with the situation of consumers' unbooking behavior, so as to provide a scientific decision-making basis for hotels.

2. Literature References

The cancellation behavior is also common in daily consumption. When the products of merchants cannot meet

their expectations or the needs of consumers change, unsubscription behavior will occur. Swinney [3] believes that consumers have different valuations of products, and Li Yongjian[4] finds that merchants adopt different return policies to bring different benefits on the basis of consumers' different valuations of products. Aiming at the return problem caused by demand uncertainty, Zhang Xuelong[5] found that the returns of each main body of the supply chain are related to the pricing model and return rate. He Yingying[6] and Song Shi[7] found that providing the corresponding return guarantee service can generate more sales and bring higher benefits to the main body of the supply chain. Prasenjit[8] introduced the cross-channel return policy and found that the valuation of products and the return rate of goods had an impact on retailers' optimal omnichannel strategy. Liu Ru[9] found that under the premise of providing return service, providing experience service can weaken consumers' willingness to unorder. Zhao Ju[10] found that the hassle cost of return will also affect the return strategy of omnichannel supply chain. Obviously, consumers' unsubscription behavior mainly affects the overall coordination of the supply chain from three aspects: return probability, product valuation and return cost.

At the early stage of the rise of the Internet, Ji Lichao[11] found that Internet technology had changed the operation and management mode of hotels and the way consumers chose to book rooms. Guo[12] found that volume discount contracts based on revenue sharing can weaken the competition between hotels and platforms, and can achieve supply chain equilibrium. Zeng Xiaoyan et al.[13] introduced the wholesale model on the basis of the agent model and found that the symmetry of information is crucial to the coordination of the supply chain. Zhang Qiaoke[14] found that in the supply chain between hotels and online platforms, high commission rates may not bring high profits to online platforms. Consumers are highly strategic, so hotels should

consider not only the impact of online platforms, but also the impact of consumer behavior when making decisions. In view of the possibility of consumers' cancellation behavior, Chen and Xie[15] found that the cancellation policy is more beneficial to consumers, so it is of great significance to formulate differentiated hotel cancellation policies. Fan Yarui[16] found that the availability of rooms determines the ordering time of consumers and the pricing decision of hotels, and the arrival rate and psychological perceived cost of consumers have an important impact on the cancellation strategy of hotels. Starting from the competitive situation of two hotels, Lu Xinyuan[17] found that in the game of cancellation strategy, the sensitivity of customers to the level of room service affected the channel party's choice of cancellation policy. Regarding the hotel supply chain, most scholars analyze the impact of factors such as the type of consumers and the arrival rate of consumers on the cooperation mode, cancellation strategy formulation and room pricing between hotels and online platforms based on the cooperation mode between hotels and online platforms. Few scholars analyze the impact of consumers' cancellation behavior on hotels from the perspective of weak hotels.

3. Problem Description and Assumptions

3.1. Description of Problem

Table 1. Parameter symbol

symbol	meaning
U_i	The utility of consumers ordering rooms, $i = G, N$
P_i	The price of a hotel room, $i = G, N$
R_i	Profit for the hotel, $i = G, N$
d_i	Demand for hotel rooms, $i = G, N$
V	Consumer valuation of hotel rooms, $0 < V < 1$
t	Fee for cancellation of room reservation
h	The loss of the hotel's reputation
C	The loss of hotel for the consumer's cancellation behavior
m	The match between the consumer and the hotel room

In the process of decision-making, the decision makers of the hotel need to consider the impact of consumers'

cancellation behavior on the revenue of the hotel. In this study, hotels are divided into competitive entities that allow cancellation and do not allow cancellation, and the strategy to obtain the optimal profit is analyzed. The influencing factors include: room matching degree, cancellation fees, reputation loss and cancellation loss of hotels.

3.2. Hypothesis of Problem

Hypothesis 1: The matching degree between the consumer and the guest room is m , so the cancellation probability is $(1 - m)$, and $0 < m < 1$.

Hypothesis 2: The room rate of the hotel is P_i , there is $i = G, N$, and $0 < P_i < 1$.

Hypothesis 3: The expected utility function of consumers ordering rooms is $U_i = m(V - P_i) - (1 - j)(1 - m)P_i - j(1 - m)t$. Among them $j = 0, 1$, and 1 means the hotel is allowed to unsubscribe policy, 0 means the hotel is not allowed to unsubscribe policy.

Hypothesis 4: The total room demand of the market is 1, and the room demand of the hotel adopting the i -strategy is d_i , there $i = G, N$ and $0 < d_i < 1$.

Hypothesis 5: There are V' and V'' between strategies that allow consumers to cancel and strategies that do not allow to cancel, and consumers have the following choices:

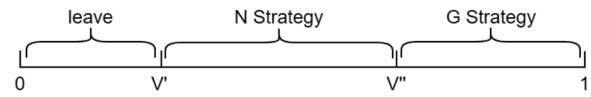


Figure 1. Consumers' range of choice

Hypothesis 6: Hotel's profit is R_i , $R_i = d_i[P_i - j(1 - m)P_i - j(1 - m)(C - t) - (1 - j)(1 - m)h]$, among them $j = 0, 1$, and 1 means that the hotel adopts G strategy, and 0 means that hotel adopts the N strategy.

Hypothesis 7: When the hotel adopts G strategy, it will cause the loss of cancellation C , and consumers are required to pay a certain amount of processing fees t . When the hotel adopts N strategy, resulting in reputation loss h . Then C , t and h are all in the interval $(0, 1)$.

4. The Model

Based on the possibility of cancellation behavior of consumers, hotels can adopt G and N strategies in the single-channel supply chain. The model of hotel single-channel supply chain is shown in Figure 2.

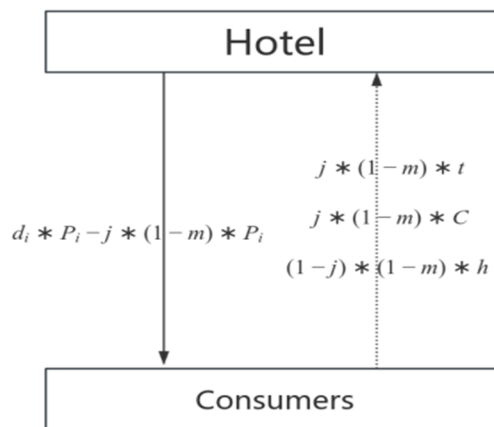


Figure 2. Single channel hotel supply chain model

According to hypothesis 4, it is known that the expected

utility of the rooms of the hotels adopting G strategy and N

strategy to consumers is as follows: $U_G = m(V - P_G) - (1 - m)t$ and $U_N = mV - P_N$. According to hypothesis 6, we get the $V' = P_N/m$ and $V'' = (1 - m)t/m + P_G$, therefore, The demand for hotel rooms under different strategies is $d_G = [m(1 - P_G) - (1 - m)t]/m$ and $d_N = [mP_G + (1 - m)t - P_N]/m$.

According to hypothesis 7, the sum of the room demand of hotels with different cancellation strategies is substituted into

the profit function of the hotels, and the profit function is obtained as $R_G = [m(1 - P_G) - (1 - m)t]/m * [mP_G - (1 - m)(C - t)]$ and $R_N = [mP_G + (1 - m)t - P_N]/m * [P_N - (1 - m)h]$.

The reverse solution method is used to solve the room pricing P_G and P_N and the profit of the hotel under different cancellation strategies, and the results are shown in Table2.

Table 2. Room rates, demand and hotel profits

	<i>G</i> strategy	<i>N</i> strategy
P_i	$[m + (1 - m)(C - 2t)]/(2m)$	$m + (1 - m)(C + 2h)/4$
d_i	$m - (1 - m)C/(2m)$	$[m + (1 - m)(C - 2h)]/(4m)$
R_i	$[m - (1 - m)C]^2/(4m)$	$[m + (1 - m)(C - 2h)]^2/(16m)$

Proposition 1: The selling price of hotel rooms is positively correlated with the loss of cancellation C . In the G strategy, the hotel room price is negatively correlated with the cancellation fee t . In the N strategy, the hotel's room price is positively correlated with the hotel's loss of reputation h .

Because of $\partial P_G/\partial C = (1 - m)/(2m) > 0$ and $\partial P_N/\partial C = (1 - m)/4 > 0$, the price of the hotel's room is directly proportional to the loss of cancellation C . Similarly, in the G strategy, there is $\partial P_G/\partial t = -(1 - m)/4 < 0$, In the N strategy, there is $\partial P_N/\partial h = 2(1 - m)/4 > 0$.

Proposition 2: In the G strategy, the demand of hotel rooms decreases with the increase of cancellation loss C . In the N strategy, the hotel room demand increases with the increase of cancellation loss C .

In the G strategy, an increase in C leads to an increase in price, so demand decreases. Similarly, in N strategy, there is $\partial d_N/\partial C = (1 - m)/(4m) > 0$, so the hotel room demand increases with the increase of cancellation loss C .

Proposition 3: In the N strategy, demand of hotel's room decreases with the increase of hotel's loss of reputation h .

In the N strategy, there is $\partial d_N/\partial h = -(1 - m)/(2m) < 0$, so the demand of hotel's room

increases with the increase of reputation loss h .

5. The Model

In order to provide the hotel decision-makers with specific unbooking strategies, this section will compare the hotel profits of G strategy and N strategy, and explore the decision plans with different critical conditions. According to the hotel profit expression in Table 2, there are $R_G - R_N = \{4[m - (1 - m)C]^2 - [m + (1 - m)(C - 2h)]^2\}/(16m)$.

The positive or negative of the comparison result is determined by $4[m - (1 - m)C]^2 - [m + (1 - m)(C - 2h)]^2$, and write it as $f(m)$, there is $f(m) = [3 + 10C - 2h + 8C^2 - (C - 2h)^2]m^2 - [16C^2 - 2(C - 2h)^2 + 10C - 2h]m + 8C^2 - (C - 2h)^2$. Let $f(m) = 0$, and there are $m' = (3C - 2h)/(1 + 3C - 2h)$ and $m'' = C + 2h/1 + C + 2h$, among them, the $m'' > 0$. Then $m' - m'' = 2(C - 2h)/[(1 + 3C - 2h)(3 + C + h)]$, the existence of $C_1' = 2h > C_1'' = 2h/3 > C_1''' = (2h - 1)/3$ make conclusions 1 and 2 valid.

Conclusion 1: When C is in interval $C_1'' < C < 1$ or $0 < C < C_1'''$, there is $m' > 0$, when in interval $C_1''' < C < C_1''$ there is $m' < 0$.

Table 3. The choice of optimal strategy

h	The magnitude of C_2''	Value range of C	Value range of m	The optimal strategy
$0 < h < \frac{\sqrt{13}-1}{4}$	$C_2'' < 0 < C_1''' < C_1'' < C_1'$	$0 < C < C_1'''$ $C_1' < C < 1$	$0 < m < m''$ $m' < m < 1$	G strategy
			$m'' < m < m'$	N strategy
		$C_1'' < C < C_1'$	$0 < m < m'$ $m'' < m < 1$	G strategy
			$m' < m < m''$	N strategy
		$C_1''' < C < C_1''$	$0 < m < m''$	N strategy
			$m'' < m < 1$	G strategy
$\frac{\sqrt{13}-1}{4} < h < 1$	$0 < C_2'' < C_1''' < C_1'' < C_1'$	$C_1' < C < 1$ $C_2'' < C < C_1'''$	$0 < m < m''$ $m' < m < 1$	G strategy
			$m'' < m < m'$	N strategy
		$C_1'' < C < C_1'$	$0 < m < m'$ $m'' < m < 1$	G strategy
			$m' < m < m''$	N strategy
		$C_1''' < C < C_1''$	$0 < m < m''$	N strategy
			$m'' < m < 1$	G strategy
		$0 < C < C_2''$	$0 < m < m''$	G strategy
			$m'' < m < 1$	N strategy

Conclusion 2: When C is in interval $C_1'' < C < 1$ or $0 < C < C_1'''$, there is $m' - m'' > 0$, when in interval $C_1''' < C < C_1''$ there is $m' - m'' < 0$.

Set $g(C) = 3 + 10C - 2h + 8C^2 - (C - 2h)^2 = 7C^2 + (10 + 4h)C + (3 - 2h + 4h^2)$, according to Veda's theorem, there is $\Delta = 16 + 136h + 128h^2 > 0$, So there is C_2' and C_2'' such that $g(C) = 0$, among them, the $C_2' = -(5 + 2h + \sqrt{4 + 34h + 32h^2})/7 < 0$ and $C_2'' = [-(5 + 2h) + \sqrt{4 + 34h + 32h^2}]/7$, and there are $C_2'' < C_1''' < C_1' < C_1'$. let $C_2'' = 0$, there is $h = (\sqrt{13} - 1)/4$. That is, when h in the interval of $0 < h < (\sqrt{13} - 1)/4$, there are $C_2'' < 0$ and the $g(C)$ rather than 0 when C in interval of $0 < C < 1$. When the h in interval of $(\sqrt{13} - 1)/4 < h <$

1, there are $C_2'' > 0$ and this $g(C)$ less than 0 when C in interval of $0 < C < C_2''$ and rather than 0 when in interval of $C_2'' < C < 1$. To sum up, two comparison results can be divided according to the value range of h , as shown in Table 3.

6. Numerical Analysis

6.1. Analysis of Room Price and Demand

The content of this section selects $C = 0.5$, $t = 0.2$, $h = 0.3$, and the degree of matching m is in the interval $(0,1)$. The influence of m on hotel room selling price and room demand is obtained, and the results are shown in Figure 3.

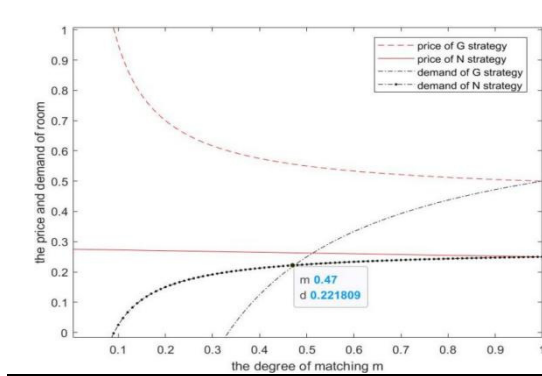


Figure 3. Influence of m on price and demand

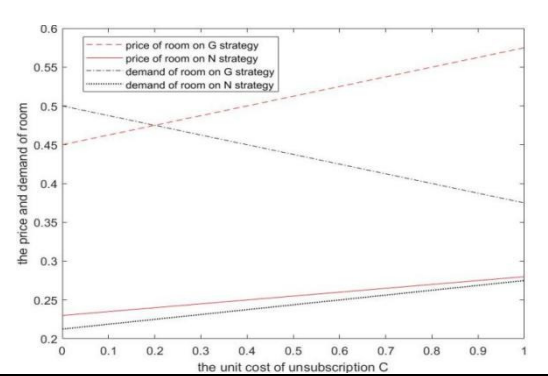


Figure 4. Impact of C on price and demand

As shown in Figure 3, with the increase of m , the price of hotel rooms is gradually decreasing, and the gap between the two prices is narrowing. At the same time, the hotel room demand increases with the increase of m , and after $m=0.47$, the room demand of G strategy is greater than that of N strategy.

The content of this section is assumed that $m = 0.8$, $t = 0.2$, $h = 0.3$ and C is in the range $(0,1)$. The influence of C on hotel room selling price and room demand is obtained. The results are shown in Figure 4.

As shown in Figure 4, the price of hotel rooms under both strategies increases with the increase of C , and the gap between the price of rooms under the two strategies widens gradually. In the G strategy, the demand of hotel's room decreases with the increase of C , but in N strategy, it can be clearly seen that hotel room demand and room price show the same trend of growth. This is due to the fact that some

travelers who have already canceled their reservations will order hotels that adopt the N strategy because of the low-priced rooms, which has resulted in a strange phenomenon of not decreasing but increasing.

6.2. Analysis of Hotel Profit under Two Factors

This section will compare the impact of m and C on hotel profits under different unbooking strategies. Set the m and C are both in the interval $(0,1)$. Then there are critical conditions $m' = (3C - 2h)/(1 + 3C - 2h)$ and $m'' = (C + 2h)/(1 + C + 2h)$ for the profit of the hotel in the G strategy and N strategy. In order to obtain the optimal cancellation decision, it is necessary to further analyze the relationship between the size of the hotel profit influenced by m and C under different cancellation strategies. Set $h = 0.2$ and $h = 0.3$, Figure 5 shows the analysis results

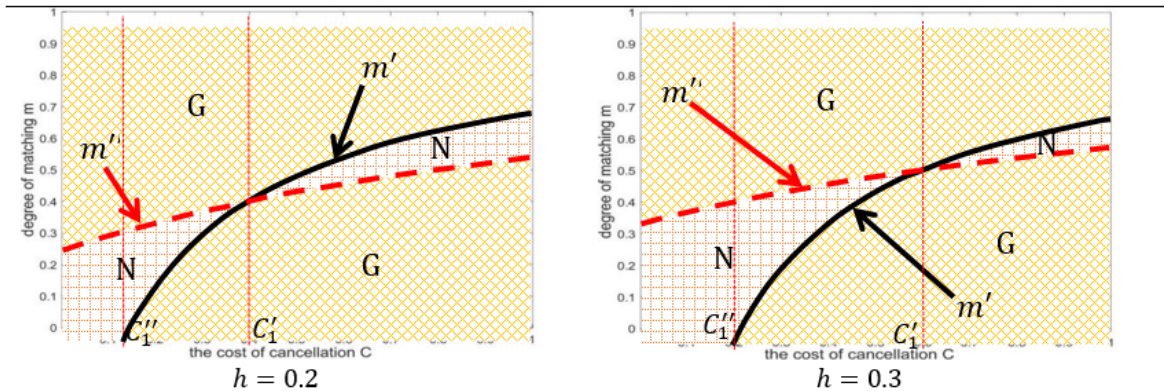


Figure 5. Distribution of policy choices

When the loss of reputation $h = 0.2$, there are two critical values $C_1' = 2/15$ and $C_1' = 0.4$, these critical values of m

are $m' = (3C - 0.4)/(0.6 + 3C)$ and $m'' = (C + 0.4)/(1.4 + C)$. When C in the interval $(0, C_1')$, so

when m is in the interval $(0, m'')$, the hotel should choose the N strategy. when m is in the interval $(m'', 1)$, hotel should choose the G strategy. Similarly, in the interval (C_1'', C_1') there is $m' < m''$, when m is on (m', m'') there is R_N is greater than R_G , when m on $(0, m')$ or $(m', 1)$ there is R_N is less than R_G . On the interval $(C_1', 1)$, there is $m' > m''$, so there is R_N is greater than R_G when m is on (m'', m') , and R_N is less than R_G on $(0, m'')$ or $(m', 1)$. In the case of hotel's loss of reputation is $h = 0.3$, the same conclusion exists, but the profit function expression is different, and each critical value is different.

When the loss of cancellation C of the hotel is in the interval $(0, 1)$, the policy of the hotel on cancellation changes from the policy of not allowing consumers to cancel to the policy of allowing consumers to cancel as the degree of matching m to hotel's rooms increases to a certain critical value. Because the loss caused by cancellation is less, the hotel can attract more room demand and gain more revenue by developing a strategy to allow consumers to cancel. When the matching degree of hotel rooms is low, the cancellation policy of the hotel changes from the policy of not allowing consumers to unsubscribe to the policy of allowing consumers to unsubscribe as the loss cancellation C increases to a certain critical value.

7. Conclusion

This study builds a single-channel supply chain model of a single hotel, analyzes the impact of consumers' unbooking behavior on the revenue of the hotel in combination with the guest room unbooking behavior in the real world, and then analyzes the problem of the hotel in the formulation of room price and the choice of whether to allow the unbooking strategy.

The findings are as follows: (1) The price of hotel's room increases with the increase of the loss of cancellation. (2) In the strategy, the demand of hotel's room decreases with the increase of the loss of cancellation. On the contrary, in the strategy, the greater the loss of cancellation, the greater the demand for hotel rooms. (3) In the strategy, hotel room demand decreases with the increase of the loss of hotel's reputation. (4) The hotel will be affected by the degree of matching to the hotel room, the loss of cancellation and the loss of reputation to the hotel in formulating the policy of cancellation strategy. (5) When the hotel is aware of the specific amount of reputational loss caused by the disallowed cancellation strategy, there are corresponding thresholds for both the degree of matching and the loss of cancellation, so that the hotel can develop the profit-optimal unbooking strategy. (6) When the loss of cancellation caused by the consumer's cancellation behavior to the hotel is within the range of, the hotel's cancellation strategy changes from the policy of not allowing consumers to cancel to the policy of allowing consumers to cancel as the degree of matching increases to a critical value. When the matching degree of hotel rooms is low, the cancellation strategy of the hotel changes from the policy of not allowing consumers to unsubscribe to the policy of allowing consumers to unsubscribe as the loss of cancellation increases to a certain critical value..

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