

# To change linen or go green : Hotel Housekeeping Service Offering as a Screening problem

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## Abstract

In this study, an economic model is employed to provide a comprehensive elucidation of the underlying rationale behind hotel business housekeeping strategies. A specialised screening model has been constructed to address this business scenario. When housekeeping costs are low, hotels should offer it, with customer incentives below the minimum value they would assign to the service. When costs are high, hotels should encourage no housekeeping with incentives above the maximum value for it. This creates a separating equilibrium, allowing hotels to cater to individual preferences. This research is unique in its analysis of hotel housekeeping services and pricing strategies within information economics, an underexplored context.

**Key words:** Hotel; Housekeeping; Screening Model; Subgame perfect equilibrium, Sustainability strategies.

## 1 Introduction

Within the realm of hospitality, hotel housekeeping plays a pivotal role in shaping the overall experience and contentment of hotel patrons. Maintaining cleanliness and comfort throughout a guest's stay is paramount. Hotel housekeeping primarily aims to elevate guest satisfaction, a goal substantiated by numerous studies exploring the interplay between housekeeping quality and guest contentment. An article featured on Hospitality Net delves into the merits of opt-out and opt-in housekeeping practices. From the hotel patrons' perspective, the primary rationale for embracing opt-in and opt-out housekeeping revolves around their preference to limit staff access to their

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rooms. Conversely, hotels' adoption of this approach stems from the challenges posed by staff shortages, which have led to a growing preference for guests to opt out of housekeeping services during their stays (B.V., 2022). The study conducted by Giovanni, Alessandro, and Napolitano (2022) underscores the central importance of guest satisfaction in the hospitality industry. The housekeeping department's role in guest satisfaction, exemplified by Isola Sacra Hotel in Italy, was examined through a literature-based analysis. It is evident that the housekeeping department significantly impacts guest satisfaction by ensuring clean, hygienic guestrooms and an inviting hotel environment. Businesses that excel in meeting guest expectations tend to achieve higher revenues. This study concludes that the housekeeping department is instrumental in enhancing guest satisfaction, potentially leading to increased guest retention, referrals, and greater profitability. These studies indicate the value hotel patrons would assign to the housekeeping services, which would be included in the model afterwards.

In terms of the current hotel policies regarding housekeeping, Hilton International has proactively addressed this issue by implementing adaptable housekeeping models across its diverse brand portfolio. Predominantly, these models involve automatic daily housekeeping services. Within Marriott's spectrum, premium resorts and luxury hotels continue to receive comprehensive daily cleaning services, including trash removal and bed-making. Premium hotels offer a similar daily housekeeping regimen. Select and extended-stay hotels within the Marriott group now provide housekeeping services every other day. In the case of IHG, luxury properties enjoy full-scale daily housekeeping services. In contrast, other IHG properties not designed for extended stays offer a "daily room refresh," with "a lighter-touch housekeeping service" that replenishes amenities, removes trash, and refreshes towels (Schulz, 2023). These practices would be simplified and defined as different policies in the model afterwards.

Furthermore, with the rising awareness of environmental protection, customers are also putting emphasis on hotels' sustainable practices. According to Han's paper (Han, 2021), the study explores how consumers perceive and respond to sustainability practices in hotels. It suggests that offering guests the option to decline daily housekeeping services can be viewed as a positive environmental initiative, potentially leading to cost savings for the hotel (Lacalle, 2023), also discusses the benefits of reducing housekeeping frequency to sustainability as business insights for hotel management. Opting out of daily housekeeping at the hotels contributes positively to environmen-

tal conservation by conserving precious resources such as water and the energy typically consumed during linen cleaning and vacuuming. These insights above laid the foundation for the possibility of future research partly in this paper, which explores the potential of promoting environmental value through reduced housekeeping services in hotels. Leveraging environmental awareness for monetisation purposes can lead to a reduction in the incentives that hotels need to provide to their guests.

On the other hand, this real-world case involves several economic concepts. Asymmetric information, also known as "information failure," occurs when one party to an economic transaction possesses greater material knowledge than the other party (Bloomenthal, 2021). Adverse selection means that if one party in the market can use more information than the other party to benefit itself and damage the other party, it tends to sign an agreement with the other party for trading, which is another problem brought by information asymmetry (Jehle and Reny, 2011). In the hotel housekeeping case, hotels are unaware of their customers' preferences. Instead of providing a single policy to all consumers, hotels can offer a menu of options for them to choose from. By doing so, hotels can screen consumers by tailoring the policies offered and induce the customers to choose the most suitable one according to their types (Jehle and Reny, 2011).

In light of ongoing labour shortages, post-pandemic effect, and a growing emphasis on environmental consciousness, hotels may find it prudent to consider reducing the frequency of housekeeping services. One of the challenges hotels face is the lack of complete information about their future guests. Consequently, they provide guests with options to customise their experience. As an example, guests are given the choice to forgo linen changes and other nightly housekeeping services. In return for this choice, hotels extend rewards to their guests. In fact, Marriott International Hotel is employing a "make a green choice" program. This program provides rewards to guests who opt for reduced housekeeping and linen changes and encourages customers to improve sustainability.

To further delve into pricing strategies and profit optimisation, it is valuable to employ concepts from information economics, including screening, asymmetric information, and adverse selection. This paper seeks to determine the most optimal strategy for hotels and how to achieve maximum profitability, given different scenarios.

For this, this paper will construct a theoretical screening model. After the model is set up, from the customer's standpoint, an exploration of net payoffs is conducted under varying "r" values, which are rewards received from the hotel to compensate for reduced housekeeping, through a process of backward induction. On the hotel side, a profit maximisation strategy is determined. Additionally, employing subgame perfect equilibrium, extensive games are employed to enhance the comprehension of the pooling and separating equilibrium utilised in real-world practices. In this way, we can analyse the hotel's housekeeping service economically and find the profit maximisation strategy.

## 2 Model

Assume there is a continuum of hotel patrons with unit mass.

There are two types of hotel patrons. The main distinction between the two types lies in the varying value they place on housekeeping between nights at the hotel. We categorise those who value housekeeping less as Type I customers and those who highly value housekeeping as Type II customers.

Specifically, both types of hotel patrons value staying at this particular hotel as  $V$  ( $V > 0$ ). Type I hotel patrons value the housekeeping between nights at  $l$ . Type I patrons account for a fraction  $\alpha$  ( $0 \leq \alpha \leq 1$ ) of the total population. In contrast, Type II hotel patrons place a higher value on housekeeping, denoted as  $h$ . Importantly,  $l < h$ , as assumed in the characteristics of the two types. Type II patrons account for a fraction of  $1 - \alpha$  of the total population. Both types of hotel patrons aim to maximise their net payoff, defined as the value of the services received minus the net payment to the hotel.

Regarding hotel services, this hotel offers two service packages. The hotel charges less if the customer does not require housekeeping between nights. Essentially, the hotel rewards customers opting out of housekeeping with a discount represented by  $r$  ( $r \geq 0$ ), as not providing housekeeping allows the hotel to save on expenses and labour costs. Staying without housekeeping incurs no additional cost, while offering housekeeping services costs  $C$  ( $C \geq 0$ ).

Let's define these services:

Package 1 (Policy 1, denoted as O1): Stay + housekeeping

- Price: Charged at  $P$

Package 2 (Policy 2, denoted as O2): Stay only (no housekeeping between nights)

- Price: Charged at  $P - r$  (where  $r \geq 0$  represents the reward for opting out of housekeeping)

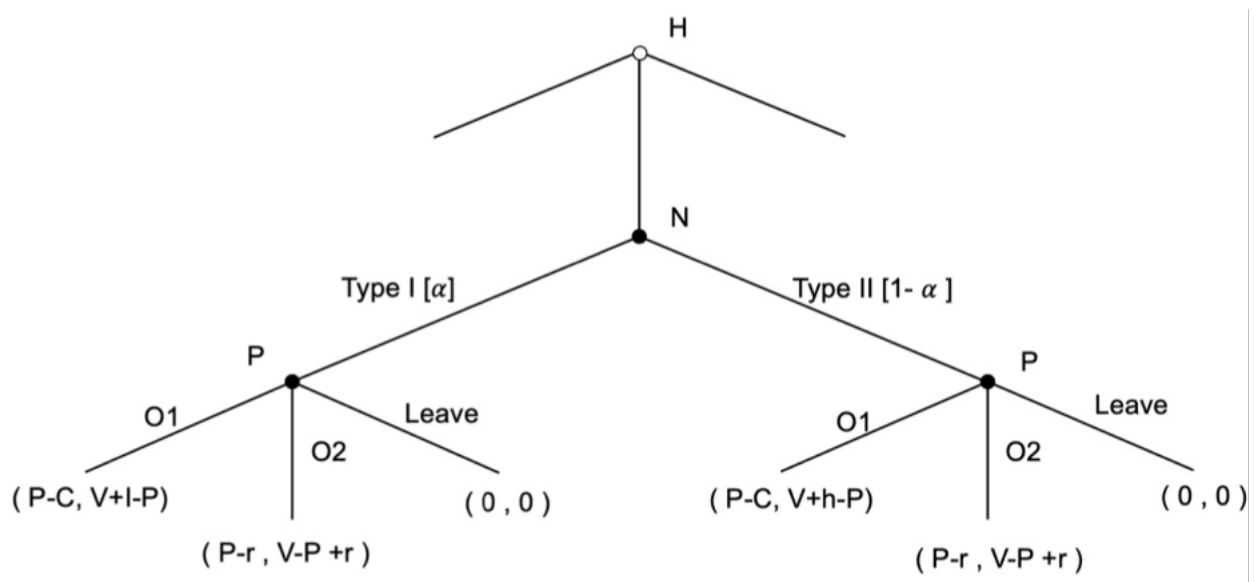
The hotel and the patrons play an extensive game, where the sequence of moves is as follows:

- The hotel moves first by simultaneously providing two service packages, in other words, two policies.
- Nature moves second and determines which type of customers the hotel faces.

The Type I hotel patrons are chosen with probability  $\alpha$ , and the Type II hotel patrons with probability  $1 - \alpha$ .

- The chosen hotel patrons move last by choosing a single policy from the two provided policies, which are O1, O2, and not staying at a hotel, which gives them zero payoff.

The game is summarised in the Game Tree below.



### 3 Analysis

The solution concept is subgame perfect equilibrium. We can solve for the equilibria of the game by performing backward induction.

We first analyse the optimal choices of the hotel patrons.

Type I Hotel Patrons:

- If they choose O1 (Service 1), their net payoff is  $V + l - P$
- If they choose O2 (Service 2), their net payoff is  $V - (P - r)$
- If  $P > V$ , they will not stay at the hotel. Their net payoff is 0

Type II Hotel Patrons:

- If they choose O1 (Service 1), their net payoff is  $V + h - P$
- If they choose O2 (Service 2), their net payoff is  $V - (P - r)$
- If  $P > V$ , they will not stay at the hotel. Their net payoff is 0

The results are: If  $r < l$ , then pooling equilibrium occurs. Both Type I and Type II hotel patrons prefer O1. If  $r = l$ , then Type I is indifferent between O1 and O2, while Type II prefers O1. If  $l < r < h$ , a separate equilibrium occurs. Type I prefers O2, while Type II prefers O1. If  $r = h$ , then Type I prefers O2, while Type II is indifferent between O1 and O2. If  $r > h$ , there is a pooling equilibrium. Both Type I and Type II hotel patrons prefer O2.

From the hotel's perspective, the goal is to maximise its expected profits, represented as  $\Pi = \Pi_1 + \Pi_2$ , where  $\Pi_1$  denotes the profit the hotel can get from Type I hotel patrons and  $\Pi_2$  denotes the profit from Type II patrons. The following scenarios would emerge:

- If  $r < l$ , Type I and Type II hotel patrons both choose O1

$$\Pi = \Pi_1 + \Pi_2 = \alpha \cdot (P - C) + (1 - \alpha) \cdot (P - C) = P - C$$

- If  $r = l$ , then Type I chooses either O1 or O2, while Type II chooses O1.

$$\Pi = \Pi_1 + \Pi_2 = \alpha \cdot (P - C) + (1 - \alpha) \cdot (P - C), \text{ which is } P - C$$

$$\text{or } \alpha \cdot (P - r) + (1 - \alpha) \cdot (P - C), \text{ which is } P - (1 - \alpha)C - \alpha r$$

- If  $l < r < h$ , Type I chooses O2, while Type II still chooses O1.

$$\Pi = \Pi_1 + \Pi_2 = \alpha \cdot (P - r) + (1 - \alpha) \cdot (P - C) = P - (1 - \alpha)C - \alpha r$$

- If  $r = h$ , then Type 1 chooses O2, while Type II chooses either O1 or O2.

$$\Pi = \Pi_1 + \Pi_2 = \alpha \cdot (P - r) + (1 - \alpha) \cdot (P - C), \text{ which is } P - (1 - \alpha)C - \alpha r$$

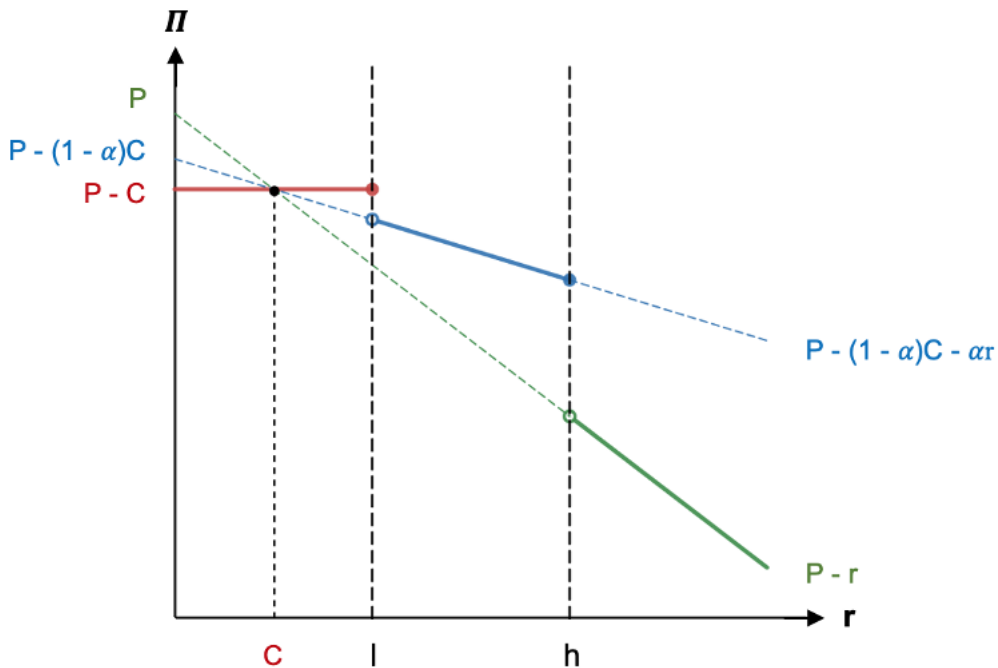
$$\text{or } \alpha \cdot (P - r) + (1 - \alpha) \cdot (P - r), \text{ which is } P - r$$

- If  $r > h$ , both Type I and Type II hotel patrons choose O2.

$$\Pi = \Pi_1 + \Pi_2 = \alpha \cdot (P - r) + (1 - \alpha) \cdot (P - r) = P - r$$

It is evident that the optimal service offering depends on  $C$ . There are three scenarios to consider.

Figure 1:



Following the analysis above, we see that "linen change" is optimal if:

$$P - C \geq P - (1 - \alpha)C - \alpha l \text{ and } P - C > P - h$$

Or equivalently, if  $C \leq l$ .

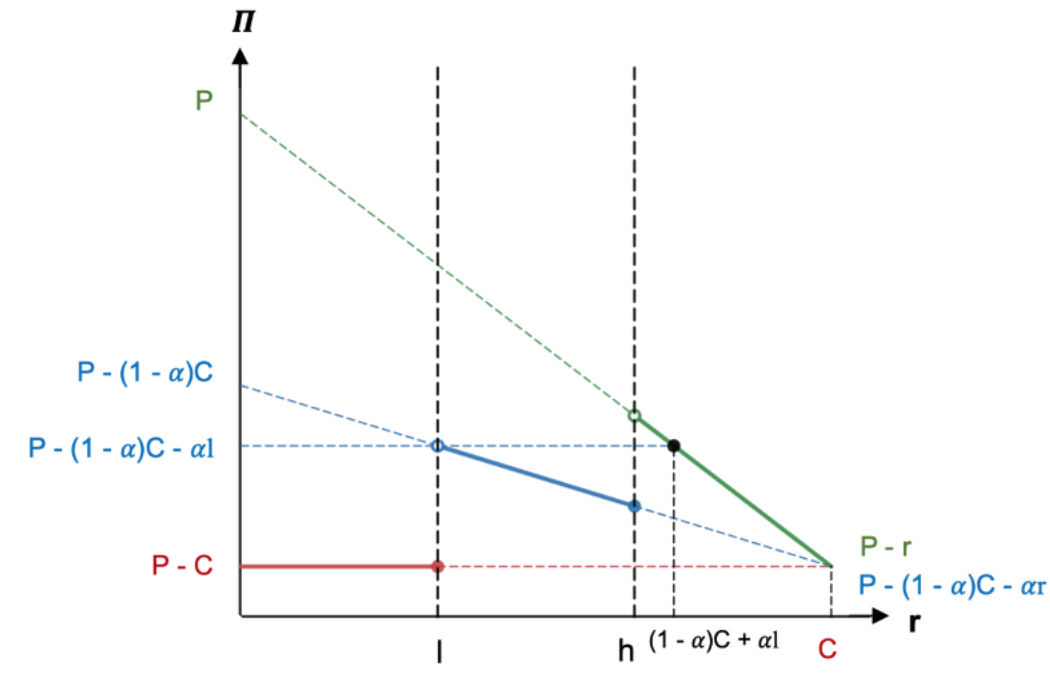
This scenario is depicted in Figure 1.

Thus, we have the following proposition:

**Proposition 1: If  $C \leq l$ , the hotel should offer housekeeping.**

When the cost of housekeeping is below the lower value (the value Type I hotel patrons assign to housekeeping between nights), it would be great for the hotel to set  $r < l$  and provide Policy I, which is providing housekeeping services. When the cost of housekeeping is less costly, the hotel should choose to provide housekeeping. By setting  $r < l$ , which means the reward hotels offer to customers is even below the least value customers would assign to housekeeping services (the value that Type I hotel patrons would assign), hotels can incentivise customers to choose housekeeping services.

Figure2:



Following the analysis above, we see that "no linen change" is optimal if:



$$P - h > P - (1 - \alpha)C - \alpha l \text{ and } P - h > P - C$$

We get  $C > (h - \alpha l)/(1 - \alpha)$

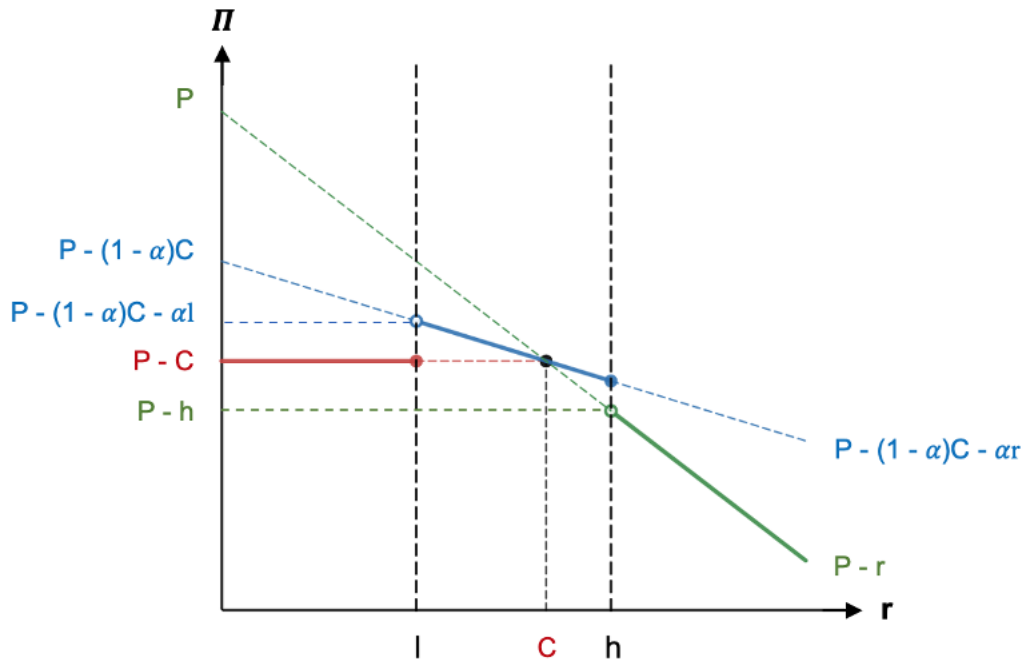
This scenario is depicted in Figure 2.

Thus, we have the following proposition:

**Proposition 2: If  $C > (h - \alpha l)/(1 - \alpha)$ , the hotel should offer no housekeeping.**

$(h - \alpha l)/(1 - \alpha)$  is the value that can make the expected profit equals  $P - h$  (denote this value as  $X$ ,  $h = \alpha l + (1 - \alpha) \cdot X$ ). Also, it can be easily proved that this value is larger than  $h$  (because  $X - h > 0$ ). The calculation result shows that when the cost of housekeeping is above  $(h - \alpha l)/(1 - \alpha)$ , it would be great for the hotel to set  $h < r < (1 - \alpha)C + \alpha l$  and provide Policy II, which is no housekeeping between nights. When housekeeping costs between nights are so high, hotels should incentivise hotel patrons to choose Policy II. To achieve this purpose, hotels can set the rewards ( $r$ ) higher than the highest value ( $h$ ) hotel patrons would assign to the housekeeping.

Figure3:



Following the analysis above, we see that offering both no linen change and linen change options to customers is optimal if:

$$P - (l - \alpha)C - \alpha l > P - C \text{ and } P - (l - \alpha)C - \alpha l > P - h$$

We get  $l < C < (h - \alpha l)/(1 - \alpha)$

This scenario is depicted in Figure 3.

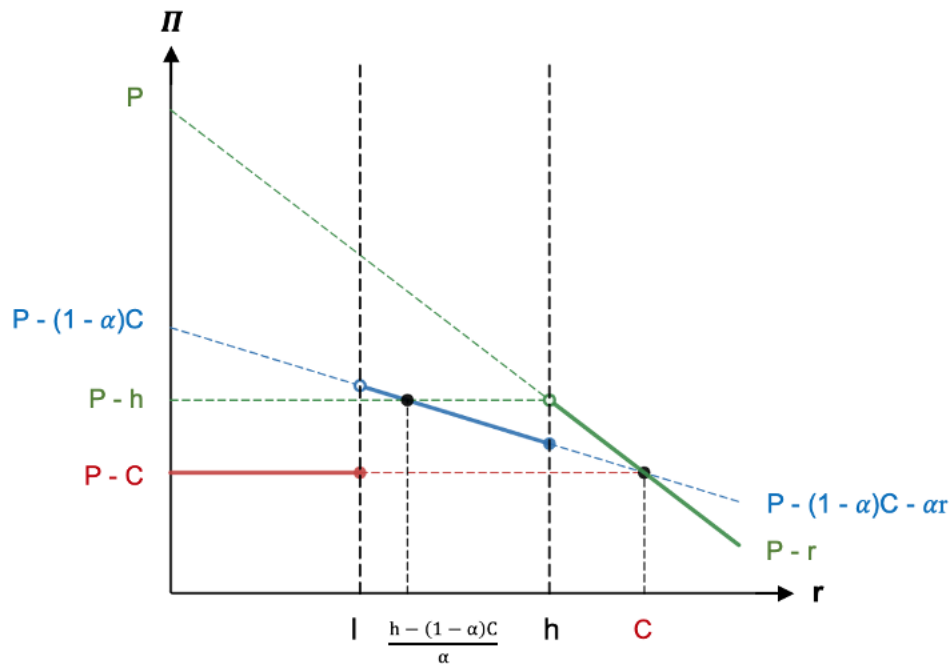
Thus, we have the following proposition:

**Proposition 3: If  $l < C < (h - \alpha l)/(1 - \alpha)$ , the hotel should offer two options (linen change and no linen change) for the customer to choose**

When the cost of housekeeping is above  $l$  and below  $(h - \alpha l)/(1 - \alpha)$ , which is the value discussed before, it would be great for the hotel to set  $l < r < h$  and provide Policy I and II for hotel patrons to choose from.

However, more specifically, proposition 3 can be divided into two scenarios where  $l < C \leq h$  and  $h < C < (h - \alpha l)/(1 - \alpha)$ . Fig 3 shows the former, and in this case, the hotel should set  $l < r < C$  to maximise the profit. The latter scenarios are shown in Figure 4. The hotel can maximise the profit by setting  $l < r < (h - (1 - \alpha)C)/\alpha$ .

Figure4:



By creating the separating equilibrium, hotels have the ability to customise their policies to

match the needs of individual consumers, thereby encouraging hotel patrons to select the policy that best suits their specific preferences. Consequently, they made the profit maximised in this situation given the certain C.

## 4 Conclusion

This study employs an economic model to explain hotel housekeeping strategies thoroughly. It utilises a specialised screening model. When housekeeping costs are low, hotels should offer the service using incentives below what customers value. Conversely, when costs are high, hotels should encourage guests to opt out of housekeeping by offering incentives above the maximum value. This creates a separating equilibrium, allowing hotels to cater to individual customer preferences. This research is a rare examination of hotel housekeeping services and pricing strategies in the context of information economics, an area that has yet to receive much attention.

While the insights derived from this research are invaluable, there are opportunities for further enrichment. For instance, as previously discussed, reducing housekeeping services represents a sustainable and environmentally friendly approach. With the growing awareness of environmental protection, hotels can launch advertising campaigns to encourage environmentally conscious guests to opt out of daily housekeeping without requiring substantial rewards in return. This concept not only enhances the intrinsic value of reduced housekeeping services but also contributes to customer satisfaction to a certain extent. The optimal strategy may undergo slight adjustments, and the marketing department would play a pivotal role in implementing this initiative.

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