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Effectiveness of Discount Incentives in Carbon Reduction: Impact of Customer-Perceived Value Sacrificed for Green Hotels

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Abstract: To improve carbon reduction efficiency, green hotels adopt cash discount incentives to encourage green customer behavior. However, the effectiveness of these incentives in promoting green customer behavior has been controversial. Prior studies argue that customer participation in green hotel practices typically involves specific sacrifices (e.g., inconvenience, lesser quality, or less luxury), going against the hedonism of tourism. Therefore, in the context of hotel carbon reduction, this study adopts mathematical modeling to investigate the impacts of customer-perceived experience sacrifice on the effectiveness of cash discount incentives. By performing backward reasoning, the study obtained the optimal pricing decisions of a green hotel, and based on which the study also observed the impact of effective discount incentives on hotel performance. It was found that cash discount incentives are effective if discounts are higher than the experience sacrifice value perceived by customers, and vice versa. Furthermore, (a proportion of) total cost savings can moderate the relationship between customer-perceived sacrifice and the effectiveness of discount incentives. The study also found that effective discount incentives always help a green hotel increase profit and occupancy, whereas whether these incentives help to reduce total carbon emissions depends on various factors that interact with each other. Findings provide a reference for green hotels to make optimal decisions on discount incentives.

Keywords: carbon reduction; green hotel; discount incentive; green customer behavior; customer-perceived sacrifice; revenue management pricing

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1. Introduction

As an energy-intensive industry, hospitality significantly contributes to global climate change by emitting greenhouse gases [1,2]. The previous literature suggests that the hotel industry is the most harmful to the environment and has the highest carbon emissions among all hospitality sectors [3–5]. According to an estimate, the hospitality industry is responsible for 21% of all CO_2 emissions, with statistics showing that 55.7 metric tons of CO_2 comes from the annual consumption of a hotel room stay per guest per night [5,6]. Moreover, this industry's carbon emissions remain upward [7]. Therefore, carbon reduction has been an issue concerning hotel management.

With the rise in environmental consciousness, customers are increasingly endorsing green hotels [8–10]. Green practices tend to be "basic" rather than "plus" in the hotel industry [11–14]. In 2020, a survey by Booking.com (accessed on 12 February 2020), one of the world's largest online hotel and accommodation booking platforms, showed that 82% of accommodation partners expect to engage in sustainable-development-related cooperation, such as the Booking Booster Accelerator Program [15]. In addition, Booking.com launched the "Travel Sustainable" program in 2021 [16], and more than 500,000 accommodations have obtained the Sustainable Travel label for their sustainable practices [17]. These accommodations can choose from 32 sustainability practices—selected for their high-impact potential and validated by independent sustainability experts [18]. These practices include providing customers with recycling bins, avoiding the use of disposable products (e.g., straws, water bottles, cutlery, and plates), introducing water-saving toilets and showers, providing customers with linen and towel reuse programs or carbon offset programs, and using LED energy-saving bulbs for lighting. Water and energy conservation, linen and towel reuse, and waste reduction have been popular and well-known green practices to reduce carbon emissions for green hotels [18–24]. Notably, these practices directly relate to hotel guests' environmentally responsible behaviors.

As a service industry, approximately half of the direct resource consumption of the hotel is related to guest rooms [25]. Thus, hotel carbon reduction needs customers' participation [26–28]. However, a gap between customers' environmental attitudes and behaviors commonly exists in the hotel context [2,3,24,29,30], that is, the customer environmental attitude–behavior gap. Due to the hedonistic nature of tourism, individuals tend to behave less environmentally while staying in hotels, thereby consuming more resources and emitting more greenhouse gases [31,32]. For example, lodging customers, particularly those who stay in a highly rated hotel (upscale/luxury), are likely to have pleasure-seeking behavioral tendencies (e.g., taking long relaxing baths daily) that increase water use [21]. These customers usually consume more water than they normally do at home [24], thus emitting more gray water and increasing carbon emissions.

Contrary to the hedonism of tourism, participation in green hotel practices often requires customers to restrict their behaviors. It may involve several sacrifices that are specific to those hotels. These sacrifices take the form of inconvenience, lesser quality, or less luxury [33]. For example, many hotels adopt linen and towel reuse programs, encouraging customers to reduce their linen and towel replacement frequency. For this, instead of washing towels and linens daily, these programs wash them on an on-call basis, inconveniencing customers. Similarly, implementing other common green practices, such as low-flow faucets, showerheads, and toilets, can also cause inconvenience to customers. In addition, some hedonic customers complain about the quality of disposable utensils' recyclable materials [14].

Prior studies argue that incentive mechanisms can trigger green customer behaviors such as linen and towel reuse, water and energy conservation, and waste reduction [34,35], which are helpful for hotel carbon reduction. Berezan et al. [36] suggested that the most popular incentive for customers to participate in green practices is receiving cash discounts. Ting et al. [37] also found that most customers favor cash discounts over eco-friendly substitutes, which is consistent with the conclusion drawn by Frey and Jegen [38]. According to Booking.com's (accessed on 15 May 2023) 2023 Sustainable Travel Report, which targeted over 33,000 travelers from 35 countries and regions worldwide, finding more rewarding sustainable travel options has become the choice of travelers more and more while facing economic pressure, such as rising daily expenses [17]. This report shows that 32% of Chinese travelers would choose sustainable travel options with discounts and economic rewards; meanwhile, 31% of Chinese travelers noted that earning bonus points that can be used to redeem free additional benefits or discounts on online travel booking websites also motivates them to travel more sustainably. However, some scholars argue that cash discount incentives are ineffective in promoting green customer behavior [34,39–41]. Their studies cannot explain why some customers are still willing to participate in green practices under cash discount incentives.

The "Value–Attitude–Behavior" theory, propounded by Homer and Kahle [42], manifests that individuals' values have a significant influence on their decision-making processes [43,44]. To be effective, the hotel must make incentive mechanisms add value to customers [45,46]. As mentioned, customers primarily seek pleasure in hotels, while participating in green practices can involve several sacrifices. Additionally, prudent customers know that participating in green practices can save hotels significant costs [34,39–41]. Therefore, participating or not participating in green practices could be the value trade-off results of customers under cash discount incentives. Before engaging in green behaviors, some customers would probably balance the relationship between cash discounts and the value sacrificed for the hotel.

Based on the values theory proposed by Schwartz [47], Stern [48] characterized broad general values into three categories—biospheric values, altruistic values, and egoistic values [49]. Egoistic values emphasize maximizing individual outcomes; altruistic values advocate a concern for the welfare of others; and biospheric values involve an inherent concern for the environment and the biosphere. Considering the hedonism of tourism as well as the monetary nature of cash discount incentives, this study focused on addressing the following three research questions from the perspective of egoistic values:

(1) Under what circumstances can cash discounts incentivize green customer behavior (i.e., participation in carbon reduction) for a green hotel?
(2) Can effective discount incentives (i.e., incentives that trigger green customer behavior) help to reduce total carbon emissions for a green hotel?
(3) Can effective discount incentives help a green hotel to improve profits?

As profit-oriented enterprises, hotels often implement revenue management pricing to maximize profits [50,51]. Thus, this study discussed the above three research questions based on the optimal pricing decisions of a green hotel. Specifically, considering the limited number of guest rooms, the study assumed that the hotel first decides the optimal room price and discount. Customers then choose whether to participate in carbon reduction, thus answering the first research question. In this process, this study adopted mathematical modeling and performed backward reasoning. Backward reasoning emphasizes inferring conditions from the target, which has been generally adopted to obtain the equilibrium result of a game between two decision-makers [52]. For instance, when making the optimal pricing decision for a hotel, it is necessary first to consider the customers' possible reactions to the discounts and room prices and their optimal choices (i.e., participation or non-participation in carbon reduction). For the second and third research questions, the study compared profits and total carbon emissions under the optimal decisions in the following two circumstances: (a) the discount incentive effectively triggers customer participation in carbon reduction, and (b) the incentive is ineffective in motivating customer participation.

Therefore, our study mainly includes three research objectives based on customers' egoistic values. The study sought to (1) examine the impact of customer-perceived sacrifice on the effectiveness of cash discount incentives; (2) obtain the optimal pricing decisions for a green hotel under different effects (i.e., ineffective and effective) of cash discount incentives; and (3) explore the impact of effective cash discount incentives on a hotel's total carbon emissions and profits. The study seeks to contribute to the extant literature on green hotels in three ways. First, this paper is among the limited number of studies regarding the effect of egoistic values and status-related motives on green customer behaviors [49]. Some scholars argue that cash discounts do not impact customers' choice to reuse linen or towels [34]. However, their studies explicated neither why some hotels still choose discount incentives nor why most customers still prefer cash discounts in practice. This study seeks these answers from the perspective of customers' egoistic values owing to the hedonism of tourism. Second, this study uniquely investigates the moderating effect of customer-perceived experience sacrifice value on the linkage between discount incentives and green customer behavior. Third, our study is novel in modeling strategic customers' decisions, observing the effectiveness of discount incentives in the context of hotel carbon reduction.

2. Literature Review

2.1. Green Hotels and Environmental Practices

The term "green hotel" has been described with alternative nomenclatures in the hospitality industry, including "eco-friendly hotel" [43] and/or "environmentally friendly hotel" [53] and/or "sustainable hotel" [54]. The Green Hotel Association [55] referred to green hotels as "environmentally friendly properties whose managers are eager to institute programs to save water, save energy, and reduced solid waste while saving money—to help protect our one and only earth". As a widely adopted definition, it has effectively highlighted that the primary purpose of environmental management practices in the hospitality industry is to minimize environmental damage [33]. Among the environmental practices commonly implemented by green hotels, linen and towel reuse programs, waste reduction, and water and energy conservation need customers' cooperation [19,21,23,24,34]. Further, the previous literature suggests that these practices significantly affect hotel carbon reduction.

Adopting linen and towel reuse programs can help green hotels to save water and energy, reduce detergent use, and lower gray water generation, thereby reducing carbon emissions [19,21]. According to the Green Lodging Calculator [20], with a towel and linen reuse program, a 150-room hotel could save 210,000 gallons of water and 143 gallons of detergent per year in addition to the energy saved. In addition, Yadav et al. [10] also argued that green hotels have successfully been managing their internal waste, thus reducing electricity and water consumption. The ITC Hotel Group, the giant of the Indian hotel industry, has become the largest "water-positive" company in the world and has gained the status of "carbon-positive" by creating certifiable CO_2 credits [43].

However, there is a widespread gap between customers' environmental attitudes and behaviors in the three mentioned dimensions of green practices. For example, Chan et al. [56] found that only 33% of customers participate in linen and towel reuse programs offered by more than 75% of hotels. In addition, Untaru et al. [24] found that some customers, although displaying great concern for the environment in the household, generally show lower intentions toward water conservation behavior in a hotel context. Therefore, triggering green customer behavior has concerned hotel management and scholars.

2.2. Discount Incentives and Green Customer Behavior

An incentive mechanism is a policy or plan that compels individuals to work toward accomplishing a certain goal [37]. In addition to achievement and recognition, monetary and material incentives are the most common incentives in management science. As monetary incentives, discount incentives' effectiveness in promoting green customer behaviors has been controversial. Based on the motivation crowding effect, some scholars argue that extrinsic monetary interventions lower intrinsic motivation [34,38,57]. Some have suggested that environmental protection is based on individuals' free will instead of cash incentives [34,39]. However, the motivation crowding effect cannot explain why most customers still favor cash discounts [36,37] nor why green hotels still implement discount incentives.

Conversely, Ting et al. [37] found that cash discount incentives moderate the relationship between hotel guests' desire intention and behavioral intention in pro-environmental behaviors (i.e., staying in green hotels). Nevertheless, their study did not expound criteria for dividing high and low discounts. To fill this gap, based on the backdrop of hotel carbon reduction, the current study seeks to investigate how much cash discounts can motivate green customer behaviors (i.e., participating in carbon reduction) from the perspective of consumers' environmental values.

2.3. Theoretical Foundation

2.3.1. Value Theory and Egoistic Values

According to Tajfel and Turner [58], individuals' values are essential in their purchase decisions, affecting consumption behavior [13]. Similarly, Homer and Kahle [42] propounded the Value–Attitude–Behavior theory, suggesting that consumer values are significant in forming environmental attitudes, which in turn result in eco-friendly behavior [43,59]. In other words, values have been considered to be an important motivator in customers' decision making to participate (or not participate) in pro-environmental behaviors [13,60].

The presence of "value" in the Value–Attitude–Behavior theory is a significant component that helps researchers understand individuals' actions within a given context [43]. It has been referred to as "a stable belief that facilitates an individual to conduct a particular action or end-state that he/she prefers" [44]. The current study considers values as biospheric, altruistic, and egoistic [13,43,47,49,60]. Compared with egoistic values, researchers pay more attention to the impacts of biospheric and altruistic values on customers' environmental attitudes and behaviors. The previous literature has been minimal regarding the effect of egoistic values and status-related motives on green product-specific behavior or behavioral intentions [43,49].

Egoistic values allude to the fact that an individual acts for himself/herself to avoid harm (i.e., acts for self-benefits) [13,43,49]. Owing to the hedonistic nature of tourism, hotel guests tend to pursue pleasure, which is one of the main reasons for the customer environmental attitude–behavior gap [31,32]. Therefore, our study innovatively investigates the effect of discount incentives on customer participation in hotel carbon reduction from the perspective of egoistic values.

2.3.2. Sacrifice for Green Hotels

Rahman and Reynolds [33] introduced two types of willingness to sacrifice when developing a comprehensive model of consumers' behavioral decisions for or against staying in green hotels. One is the willingness to sacrifice for the environment, and the other is the willingness to sacrifice for green hotels. Willingness to sacrifice involves "foregoing one's own immediate self-interests to promote the well-being of the partner or relationship" [33,61]. Customers who have a robust biospheric value orientation will be more willing to make sacrifices for the environment [62]. According to Rahman and Reynolds [33], willingness to sacrifice for the environment will positively influence consumer visit intention and willingness to pay more for a green hotel.

Compared with the willingness to sacrifice for the environment, the willingness to sacrifice for green hotels is more product-specific [33]. The product-specific sacrifice can lead to a financial sacrifice (e.g., paying more for a green hotel) and the sacrifice of convenience, quality, or luxury offered by the hotel. Consumers generally associate green hotels with lower comfort, inconvenience, and high price premiums [14,33,63]. The previous literature has confirmed that customers' willingness to sacrifice for the environment positively affects their willingness to sacrifice for a green hotel [33]. However, there is no literature to investigate how customer-perceived sacrifice for a green hotel affects a customer's willingness to sacrifice for the environment. The current study considers this problem under cash discount incentives to fill this gap.

2.3.3. Revenue Management Pricing

The number of rooms for a hotel is limited (i.e., fixed capacity), and the residual value of unoccupied rooms on the day is zero (i.e., perishability of room value). Thus, revenue management theory, propounded by Kimes [64], has been commonly applied to hotel management to efficiently manage the effects of capacity [52,65,66]. Revenue management is a method that can help a firm sell the right inventory unit to the right type of customer at the right time and for the right price [64]. It guides allocating undifferentiated capacity units to available demand to maximize profit or revenue. According to the revenue management theory, pricing is a crucial strategy and significantly affects hotel performance [64,67–69]. Various pricing strategies commonly used by hotels include demand-based pricing, cost-based pricing, market penetration pricing, product bundling pricing, optional pricing, psychological pricing, promotional pricing, and exclusive pricing [50,70]. Among these nine strategies, Nair [50] found that demand-based pricing, optional product pricing, psychological pricing, and promotional pricing have a significant relationship with revenue management performance, influencing the gaining of competitive advantage.

Prior studies in revenue management pricing have focused on financial performance (profits) instead of environmental performance (e.g., carbon emissions). Further, the literature exploring revenue management pricing regarding green management practices has needed to be more extensive in the hospitality industry [51]. Xu et al. [51] found that sustainability costs negatively affect the optimal pricing of a hotel. Additionally, their study suggested that factors positively influencing demand levels play critical roles in determining optimal hotel pricing. Although implementing discount incentives can add sustainability costs for a hotel, this will also help hotels to stimulate market demand. In addition, if customers participate in carbon reduction under a discount incentive mechanism, hotels can reduce expenditures [34,39–41], thus becoming more competitive [71]. Therefore, our study first considered these issues to perform revenue management pricing (demand-based pricing) of a green hotel based on the analysis of Xu et al. [51]. Results provide a valuable reference for green hotels to make optimal decisions on pricing and discount incentives in carbon reduction.

3. Model Description

3.1. Problem Description

This study supposed that a green hotel implements cash discount incentives to trigger green customer behavior (i.e., participation in carbon reduction). As discount incentives follow the principle of voluntariness, customers can choose whether to behave in a green way to reduce carbon emissions when they check into the hotel. Participation in carbon reduction usually involves several specific sacrifices (e.g., inconvenience, lesser quality, or less luxury) for a green hotel [14,33], while customers generally pursue pleasure when staying in the hotel [21,31,32]. Thus, according to the Value–Attitude–Behavior theory and egoistic values [42,48], customers will make decisions (i.e., whether to participate in carbon reduction) by maximizing their outcomes or utility [43,44,49]. Therefore, customer-perceived value sacrificed for the hotel could influence the effectiveness of discount incentives.

Implementing optimal pricing is an effective method for maximizing hotel profits [50,51]. Thus, our study assumed that room price and discount are the decision variables of the green hotel adopting discount incentives. Moreover, hotel pricing tends to consider market situations such as peak or off-season [51,64], owing to the limited available rooms. Thus, demand forecasting is the premise of pricing and discounting. This study assumed that the hotel predicts market demand based on customer utility. Lastly, as the literature indicates that mathematical modeling helps to address the pricing problems involved in revenue management [51,64], the current study adopted mathematical models for characterizing the effect of cash discount incentives on green customer behavior and optimal hotel decision making. Specifically, whether cash discount incentives can trigger green customer behavior (in carbon reduction) and help the hotel to reduce total carbon emissions and increase profits is observed.

3.2. Model Assumptions and Notations

To facilitate the analysis, our study considered the following scenarios and assumptions. First, this study assumed that discount (d) and room price (p) are decision variables of the hotel. As differential pricing will affect customers' fairness perception [67], the study adopted the single pricing model, and the hotel offers customers an exact room price (p).

Second, as the hotel's available rooms are limited, the hotel needs to consider the number of available rooms ($Q \in (0, 1]$) when making optimal decisions on room price and discount. This study normalized all items between 0 and 1 to facilitate the analysis.

Third, owing to the consumption of, for example, water, energy, linen, towels, or disposable products, each room has a variable cost $c \in (0, 1)$ and carbon emissions. This study normalized carbon emissions per room occupied by N-type customers to 1 to facilitate analysis, and I-type customers were $1 - r_L$, where $r_L \in (0, 1)$ represents a reduced carbon emission quantity. The carbon emission cost per unit is $c_E \in (0, 1)$. Furthermore, the variable cost per room savings due to customer involvement in hotel carbon reduction is $v \in (0, c)$.

Fourth, the current study derived the market demand from customer utility and the factors affecting the utilities of N-type and I-type customers are different. For both of the two types of customers, the individual utility is negatively related to room price (p) but positively correlated with the general initial perceived utility (i.e., customer-perceived experience) θ_i, where $i = 1, 2, \ldots$ and $\theta_i \sim Uniform(0, 1)$. However, unlike N-type customers, owing to participation in carbon reduction, I-type customers can receive a discount from the hotel, and thus the individual utility will increase with it. However, participation in carbon reduction often involves some specific sacrifices, and thus this negatively influences the perceived experience for this type of customer [14,33]. For this, this study characterizes this phenomenon as $b\theta_i$, where $b \in (0,1)$ is the negative influence coefficient of customer participation in hotel carbon reduction on customer-perceived experience [21,53,72–74]. I-type customers' perceived experience changes from θ_i to $b\theta_i$. Thus, $1-b$ means the level of customer-perceived experience sacrifice, and I-type customers perceive more sacrifices for hotel carbon reduction for a smaller b. Moreover, $p(1-b)$ suggests the customer-perceived value sacrificed for the hotel. The utilities of I-type and N-type customers are, respectively, given by

$$U_N = \theta_i - p, \text{ and} \tag{1}$$

$$U_I = b\theta_i - p + d \tag{2}$$

Customers reserve a room from the hotel if $U_N > 0$ or $U_I > 0$.

Fifth, this study assumed that customers could choose to become I-type or N-type, but there is only one opportunity for them to do this. In addition, from the perspective of egoistic values, these customers are supposed to be rational. Thus, they will not participate in carbon reduction if $U_N > U_I > 0$, thereby becoming the N-type; otherwise, if $U_I \geq U_N > 0$, they will participate in carbon reduction and thus become the I-type customers.

Proposition 1. *For any $p \geq 0$, (a) if $d \geq p(1-b)$, customers with $\theta_i \in \left(\frac{p-d}{b}, \frac{d}{1-b}\right]$ will participate in hotel carbon reduction while those with $\theta_i > \frac{d}{1-b}$ will not; (b) if $d < p(1-b)$, those with $\theta_i \in (p, 1]$ will check into the hotel, but none of them will participate in hotel carbon reduction.*

All proofs of propositions are presented in Supplementary D. Proposition 1 indicates that if the discount is no less than the customer's perceived value sacrificed for the hotel, some customers will choose to participate in carbon reduction. The discount incentive is effective in this case, termed "Case-E". Otherwise, if the discount cannot compensate for the customer-perceived value sacrificed for the hotel, no customer will participate in carbon reduction, and the discount incentive will be ineffective (termed "Case-I"). Case-I is equivalent to the case without discount incentives.

In Case-E, $\frac{d}{1-b} \gtreqless 1$ is possible. As $\theta_i \sim Uniform(0,1)$, the hotel has both I-type and N-type customers if $\frac{d}{1-b} < 1$. As some customers staying in the hotel are still reluctant to participate in carbon reduction, the discount incentive is "partially effective" (Case-PE). In contrast, all customers will participate in hotel carbon reduction if $\frac{d}{1-b} \geq 1$ and the discount incentive is "fully effective" (Case-FE). This study uses superscript $n = PE, FE$ to represent Case-PE and Case-FE, respectively. No optimal solution exists for the hotel for $\frac{d}{1-b} > 1$ (its proof is given in Supplementary C). Therefore, this study only considers the case for $\frac{d}{1-b} \leq 1$.

3.3. Model Formulation

The optimization problem of the hotel is given by Equation (3).

$$\begin{aligned} &Max\ \pi = D_N(p-c-c_E) + D_I[p-c+v-c_E(1-r_L)-d] \\ &\text{s.t. } D_T \leq Q, \\ &p, d \geq 0, \end{aligned} \tag{3}$$

where $D_N(p-c-c_E)$ and $D_I[p-c+v-c_E(1-r_L)-d]$ are, respectively, the profits of rooms occupied by N-type and I-type customers, and $D_T = D_N + D_I$ is the total occupancy. The first constraint represents the fact that the room occupancy cannot exceed that of the available rooms.

3.3.1. Case-E: Effective Discount Incentive

According to Proposition 1 and $\theta_i \sim Uniform(0,1)$, the demands of N-type and I-type customers in Case-E are, respectively, given by Equations (4) and (5).

$$D_{N,1} = \int_{\frac{d}{1-b}}^{1} \theta_i d\theta_i = 1 - \frac{d}{1-b}, \tag{4}$$

$$D_{I,1} = \int_{\frac{p-d}{b}}^{\frac{d}{1-b}} \theta_i d\theta_i = \frac{d}{1-b} - \frac{p-d}{b} = \frac{d-p(1-b)}{b(1-b)} \tag{5}$$

Consequently, the total demand and total carbon emissions of the hotel are, respectively, given by Equations (6) and (7).

$$D_{T,1} = D_{N,1} + D_{I,1} = 1 - \frac{p-d}{b}, \tag{6}$$

$$E_{T,1} = D_{N,1} + D_{I,1}(1-r_L) = 1 - \frac{p-d}{b} - \frac{r_L[d-p(1-b)]}{b(1-b)}. \tag{7}$$

As $D_N \geq 0$ in Case-E, this study obtained the constraint $d/(1-b) \leq 1$. According to Equations (3)–(5), the optimization problem of the hotel is given by Equation (8).

$$\begin{aligned} &Max\ \pi_1 = \left(1 - \tfrac{p-d}{b}\right)(p-c-c_E) + \left(\tfrac{d}{1-b} - \tfrac{p-d}{b}\right)(v + c_E r_L - d) \\ &\text{s.t.} \quad 1 - \tfrac{p-d}{b} \leq Q, \\ &\qquad\ \ p(1-b) \leq d \leq 1-b, \\ &\qquad\ \ p, d > 0. \end{aligned} \tag{8}$$

3.3.2. Case-I: Ineffective Discount Incentive

There is no I-type customer in Case-I. According to Proposition 1, the total demand or the demands of the N-type customers are given by Equation (9).

$$D_{N,2} = \int_{p}^{1} \theta_i d\theta_i = 1 - p, \tag{9}$$

Hence, the total carbon emissions of the hotel are given by Equation (10).

$$E_{T,2} = 1 \times D_{N,2} = 1 - p. \tag{10}$$

According to Equations (3) and (9), the optimization problem of the hotel is given by Equation (11).

$$\begin{aligned} &Max\ \pi_2 = (1-p)(p-c-c_E) \\ &\text{s.t.} \quad 1 - p \leq Q, \\ &\qquad\ \ d < p(1-b), \\ &\qquad\ \ p, d > 0. \end{aligned} \tag{11}$$

Table 1 summarizes all of the notations of this paper. The main content defines and refers to them all (see Sections 3 and 4).

Table 1. Notations.

Notations	Description
π	The profit of the hotel.
$Q \in (0,1)$	Quantity of the available rooms.
$p > 0$	Room price (decision variable).
U_k	Utility of the $k-$type customers, where $k = \{N, I\}$.
D_T	Total demand of the hotel.

Table 1. *Cont.*

Notations	Description
$\theta_i \sim U(0,1)$	Initial perceived utility for customer i to stay in the hotel.
$b \in (0,1)$	Negative influence coefficient of customer participation (in carbon reduction) on customer-perceived experience.
$c \in (0,1)$	Variable cost per room.
$c_E \in (0,1)$	Carbon emission cost per unit.
$v \in (0,c)$	Variable cost savings per room due to carbon reduction.
$d \geq 0$	Discount per room for customers participating in carbon reduction (decision variable).
$r_L \in (0,1)$	Average reduced carbon emissions per room for I-type customers (the carbon emissions rate is 1 for N-type customers).
E_T	Total carbon emissions of the hotel.
Superscript *	Associated values under optimal decisions of the hotel.

4. Results

4.1. Optimal Price and Discount of the Green Hotel

Tables 2 and 3 show the hotel's optimal price, associated occupancy, profits, and total carbon emissions in Case-E and Case-I (all derivations are presented in Supplementaries A and B). Due to limited available rooms, there are two market situations under the optimal pricing: rooms available and fully occupied. Let superscript $j = A, O$ represent the case that the hotel is not full (rooms available) and fully occupied, respectively. In Tables 2 and 3, $\overline{Q}_1 = \frac{b-c+v-c_E(1-r_L)}{2b}$ and $\overline{Q}_2 = \frac{1-(c+c_E)}{2}$ are, respectively, the thresholds of Q when all rooms are sold out in Case-E and Case-I. Specifically, in Case-E (Case-I), all rooms will be sold out when $Q \leq \overline{Q}_1$ ($Q \leq \overline{Q}_2$), whereas there are still unoccupied rooms if $Q > \overline{Q}_1$ ($Q > \overline{Q}_2$).

Table 2. The optimal results in Case-E.

	$Q > \overline{Q}_1$ **(Rooms Available)**	$Q \leq \overline{Q}_1$ **(Fully Occupied)**
$\text{Case}-\text{PE}:\ v + c_E r_L < 1 - b \leq \frac{c_E r_L + v}{c + c_E}$		
The optimal price	$p_{PE}^{A*} = \frac{1+c+c_E}{2}$	$p_{PE}^{O*} = \frac{[1+b(1-2Q)+c_E r_L+v]}{2}$
Discount	$d_{PE}^{A*} = \frac{1-b+c_E r_L+v}{2}$	$d_{PE}^{O*} = \frac{1-b+c_E r_L+v}{2}$
Occupancy:		
Total	$D_{T,PE}^{A*} = \overline{Q}_1$	$D_{T,PE}^{O*} = Q$
I-Type	$D_{I,PE}^{A*} = \frac{v-c(1-b)-c_E(1-b-r_L)}{2b(1-b)}$	$D_{I,PE}^{O*} = \frac{c_E r_L+v-(1-2Q)(1-b)}{2(1-b)}$
N-Type	$D_{N,PE}^{A*} = \frac{1-b-v-c_E r_L}{2(1-b)}$	$D_{N,PE}^{O*} = \frac{1-b-v-c_E r_L}{2(1-b)}$
Profit	$\pi_{PE}^{A*} = \frac{[c+c_E(1-r_L)-v]^2+b(c+c_E)[2(c_E r_L+v)-c-c_E]}{4b(1-b)} - \frac{2(c+c_E)-1}{4}$	$\pi_{PE}^{O*} = \frac{1-b(1-2Q)^2-4Q(c+c_E)-2(1-2Q)(c_E r_L+v)}{4} + \frac{(c_E r_L+v)^2}{4(1-b)}$
Total carbon emissions	$E_{T,PE}^{A*} = \frac{b(1-b-c_E r_L)-c(1-b)(1-r_L)+[v-c_E(1-r_L)](1-b-r_L)}{2b(1-b)}$	$E_{T,PE}^{O*} = Q(1-r_L) + \frac{r_L(1-b-c_E r_L-v)}{2(1-b)}$
$\text{Case}-\text{FE}:\ 1 - b \leq v + c_E r_L$		
The optimal price	$p_{FE}^{A*} = 1 - \frac{b-c+v-c_E(1-r_L)}{2}$	$p_{FE}^{O*} = 1 - bQ$
Discount	$d_{FE}^{A*} = 1 - b$	$d_{FE}^{O*} = 1 - b$
Occupancy	$D_{T,FE}^{A*} = \overline{Q}_1$	$D_{T,FE}^{O*} = Q$
Profit	$\pi_{FE}^{A*} = \frac{[b-c+v-c_E(1-r_L)]^2}{4b}$	$\pi_{FE}^{O*} = Q[(1-Q)b - c + v - c_E(1-r_L)]$
Total carbon emissions	$E_{T,FE}^{A*} = (1-r_L)\overline{Q}_1$	$E_{T,FE}^{O*} = (1-r_L)Q$

Note(s): (1) $\overline{Q}_1 < \frac{1}{2}$, as $c - v > 0$ and $0 < r_L < 1$. (2) As $0 < c + c_E < 1$, $1 - v - c_E r_L > 1 - \frac{c_E r_L + v}{c + c_E}$.

Table 3. The optimal results of the green hotel in Case-I.

	$Q > \overline{Q}_2$ **(Rooms Available)**	$Q \leq \overline{Q}_2$ **(Fully Occupied)**
The optimal price	$p_2^{A*} = \frac{1+c+c_E}{2}$	$p_2^{O*} = 1 - Q$
Discount	$d_2^{A*} < \frac{(1-b)(1+c+c_E)}{2}$	$d_2^{O*} < (1-b)(1-Q)$
Occupancy	$D_{T,2}^{A*} = \overline{Q}_2$	$D_{T,2}^{O*} = Q$
Profit	$\pi_2^{A*} = \frac{[1-(c+c_E)]^2}{4}$	$\pi_2^{O*} = Q[1 - Q - (c + c_E)]$
Total carbon emissions	$E_{T,2}^{A*} = \frac{1-(c+c_E)}{2}$	$E_{T,2}^{O*} = Q$

Proposition 2. *In Case-E, (a) the occupancy of the hotel does not affect the optimal discounts, but the effectiveness (partially or fully effective) of the discount incentive does, and (b) the greater the customer-perceived sacrifices for the green hotel, the more the discount is needed to make the discount incentive effective no matter whether the hotel rooms are fully occupied, as* $\frac{\partial d_j^{i*}}{\partial b} < 0$ *for all* $i = \{A, O\}$ *and* $j = \{PE, FE\}$.

Proposition 3. *(a) In Case-PE, the customer-perceived sacrifice for the hotel does not affect the optimal pricing when the hotel is not full, as* $\frac{\partial p_{PE}^{A*}}{\partial b} = 0$*, but it negatively affects the pricing when the hotel is fully occupied, as* $\frac{\partial p_{PE}^{O*}}{\partial b} > 0$*. (b) In Case-FE, the customer-perceived sacrifice always positively affects the optimal pricing, as* $\frac{\partial p_{FE}^{O*}}{\partial b} < 0$ *and* $\frac{\partial p_{FE}^{P*}}{\partial b} < 0$.

Proposition 3 suggests that coefficient (b) nearly oppositely affects the optimal pricing in Case-PE and Case-FE. In Case-FE, the hotel needs to synchronize the price and discount with customer-perceived sacrifice to attract all of its customers to participate in carbon reduction and obtain the most profit. However, in Case-PE, the hotel only needs to maximize its profit. Thus, when a higher discount is offered to attract customers to participate in carbon reduction for a minor b, the hotel does not change or even decreases the price to attract more I-type customers (see Equation (5)).

4.2. Optimal Discount Incentive Effectiveness

As $b \geq 1 - \frac{c_E r_L + v}{c + c_E}$ for Case-E is optimal (Table 2), the green hotel does not provide a discount incentive for $b < 1 - \frac{c_E r_L + v}{c + c_E}$. Here, $c_E r_L + v$ is the total cost saved due to carbon reduction, while $c + c_E$ is the total cost before carbon reduction. Hence, $\frac{c_E r_L + v}{c + c_E}$ represents the proportion of the cost saved by the hotel owing to carbon reduction, and thus $1 - \frac{c_E r_L + v}{c + c_E}$ (i.e., $\frac{c_E(1-r_L)+(c-v)}{c+c_E}$) is the proportion of the actual consumption cost. Moreover, as $\overline{Q}_1$ and $\overline{Q}_2$ are generally different (i.e., $\overline{Q}_1 \gtreqless \overline{Q}_2$ if and only if $b \gtreqless 1 - \frac{v + c_E r_L}{c + c_E}$), there are three mutually exclusive situations, as shown in Figure 1. In a "bad market situation" (BS), the hotel is not full in both Case-E and Case-I. In a "good market situation" (GS), the hotel is fully occupied in both Case-E and Case-I. In a "moderate market situation" (MS), the hotel is not full in Case-I, while it could be fully occupied in Case-E.

Define Δp_s^n, ΔD_s^n, $\Delta \pi_s^n$, and ΔE_s^n, for $n = PE, FE$ and $s =$ BS, GS, MS, as the differences in optimal prices, occupancy rates, profits, and total carbon emissions between Case-PE (Case-FE) and Case-I for an individual situation. All derivations of the comparison results between Case-E and Case-I are presented in Supplementary E. As shown in Table 4, an effective discount incentive always enhances a hotel's profit. Proposition 4 and Figure 2 summarize this finding.

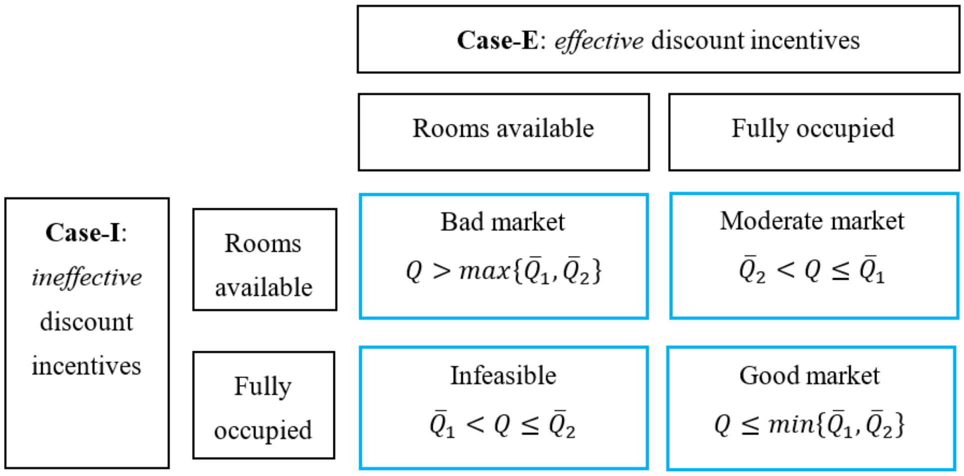

Figure 1. Three market situations.

Table 4. Profit comparisons.

Circumstances	**Comparison Results**
Case-PE vs. Case-I	
$\Delta\pi_{BS}^{PE} = \pi_{PE}^{A*} - \pi_2^{A*}$	$= \frac{[v-c(1-b)-c_E(1-b-r_L)]^2}{4b(1-b)} > 0.$
$\Delta\pi_{MS}^{PE} = \pi_{PE}^{O*} - \pi_2^{A*}$	$= \frac{1-b(1-2Q)^2-4Q(c+c_E)-2(1-2Q)(c_E r_L+v)}{4} + \frac{(c_E r_L+v)^2}{4(1-b)} - \frac{[1-(c+c_E)]^2}{4} > 0.$
$\Delta\pi_{GS}^{PE} = \pi_{PE}^{O*} - \pi_2^{O*}$	$= \frac{[(1-b)(2Q-1)+v+c_E r_L]^2}{4(1-b)} > 0.$
Case-FE vs. Case-I	
$\Delta\pi_{BS}^{FE} = \pi_{FE}^{A*} - \pi_2^{A*}$	$= \frac{1}{4}\left\{\frac{[b-c+v-c_E(1-r_L)]^2}{b} - [1-(c+c_E)]^2\right\} > 0.$
$\Delta\pi_{MS}^{FE} = \pi_{FE}^{O*} - \pi_2^{A*}$	$= Q[(1-Q)b - c + v - c_E(1-r_L)] - \frac{[1-(c+c_E)]^2}{4} > 0.$
$\Delta\pi_{GS}^{FE} = \pi_{FE}^{O*} - \pi_2^{O*}$	$= Q[v + c_E r_L - (1-b)(1-Q)] > 0.$

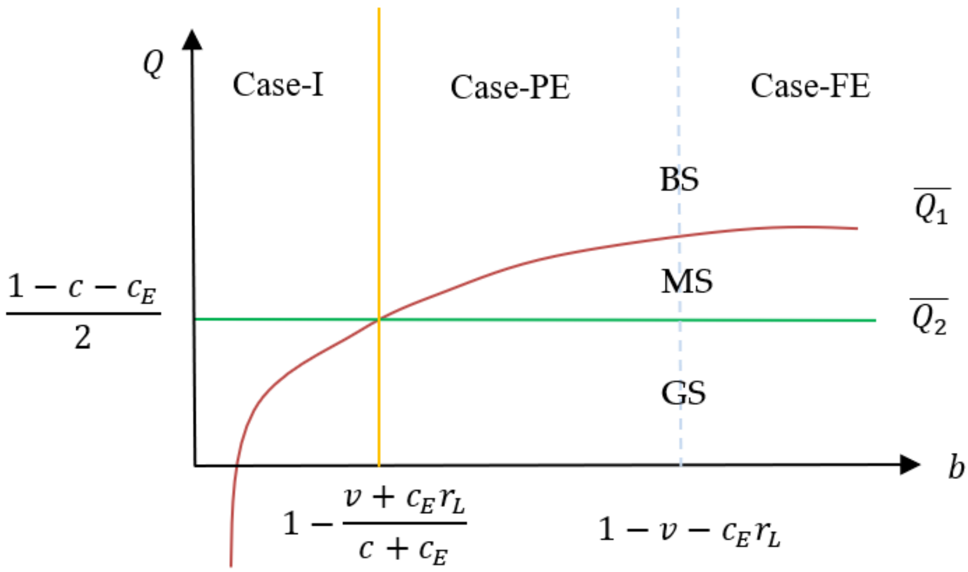

Figure 2. Regions of optimal discount incentive effectiveness and three situations.

Proposition 4. *It is optimal for the green hotel (a) NOT to provide discount incentives if the customer-perceived experience sacrifice is considerable with* $1-b > \frac{c_E r_L + v}{c+c_E}$*; (b) to provide a* *partially effective discount incentive if the customer-perceived experience sacrifice is moderate with* $v + c_E r_L < 1 - b \leq \frac{c_E r_L + v}{c + c_E}$*; and (c) to provide a fully effective discount incentive if the perceived experience sacrifice is small with* $1 - b \leq v + c_E r_L$.

Proposition 4 reveals that the smaller the customer-perceived experience sacrifice $(1 - b)$, the more significant the discount incentive is in enhancing the green hotel's profit. If the customer-perceived experience sacrifice is substantial, exceeding the proportion of total cost savings, i.e., $1 - b > \frac{c_E r_L + v}{c + c_E}$, customers are too concerned about the perceived experience but not carbon emissions, which makes hotel carbon reduction extremely difficult. Thus, the discount incentive completely fails, and the hotel pretends to refrain from implementing any discount incentive. Therefore, the proportion of total cost savings due to carbon reduction, i.e., $\frac{c_E r_L + v}{c + c_E}$, moderates the relationship between customer-perceived experience sacrifice and discount incentive effectiveness.

Proposition 4 also suggests that the hotel should provide fully effective discount incentives if the perceived sacrifice is not greater than the total cost saving due to carbon reduction, i.e., $1 - b \leq v + c_E r_L$. Further, according to Proposition 4(c), when customers believe that participating in emission reduction can save the hotel far more costs than their perceived experience sacrifice, the discount incentives can usually be partially effective.

4.3. Performance in Occupancy and Prices

Table 5 indicates that the room occupancy rates in Case-FE and Case-PE are always higher than in Case-I when the market is bad or moderate. This is because, once the discount is higher than the sacrifice value perceived by customers, this discount incentive is effective and can help to attract more customers to check into the hotel (see Equations (6) and (9)) if there are available rooms. Therefore, discount incentives promote green customer behavior and help to increase room occupancy when the hotel is not full.

Table 5. Occupancy comparisons.

Circumstances	Comparison Results
Case-PE vs. Case-I	
$\Delta D_{BS}^{PE} = D_{T,PE}^{A*} - D_{T,2}^{A*}$	$= \frac{v - c(1-b) - c_E(1-b-r_L)}{2b} > 0$
$\Delta D_{MS}^{PE} = D_{T,PE}^{O*} - D_{T,2}^{A*}$	$= \frac{2Q - (1-c-c_E)}{2} > 0$
$\Delta D_{GS}^{PE} = D_{T,PE}^{O*} - D_{T,2}^{O*}$	$= 0$
Case-FE vs. Case-I	
$\Delta D_{BS}^{FE} = D_{T,FE}^{A*} - D_{T,2}^{A*}$	$= \frac{v - c(1-b) - c_E(1-b-r_L)}{2b} > 0$
$\Delta D_{MS}^{FE} = D_{T,FE}^{O*} - D_{T,2}^{A*}$	$= \frac{2Q - (1-c-c_E)}{2} > 0$
$\Delta D_{GS}^{FE} = D_{T,FE}^{O*} - D_{T,2}^{O*}$	$= 0$

4.3.1. Case-PE

Table 6 shows that hotel room prices in Case-PE and Case-I are identical when the market is bad, i.e., $\Delta p_{BS}^{PE} = 0$. If there are still unoccupied rooms, the hotel's primary purpose is to attract customers as much as possible. Thus, the hotel will not raise the room price. However, the hotel will not lower the price either, as some customers are still reluctant to participate in carbon reduction, which would not help to save costs for the hotel. Further, it would increase the hotel's expenditures to give discounts to customers who participate in carbon reduction. Last, in the bad market, owing to the identical room prices, the higher occupancy of Case-PE (Table 5) results in a higher profit (Table 4). When the market is moderate or good, room prices in Case-PE are always higher than in Case-I, i.e., $\Delta p_{MS}^{PE} \geq 0$ and $\Delta p_{GS}^{PE} > 0$. This indicates that if the discount incentive can attract some customers to participate in carbon reduction, the hotel should maintain the unchanged room price when it is not full, but raise the price when it is fully occupied. A successfully implemented discount incentive can help to attract more customers and save operating and emission costs for the green hotel, while it can also bring the hotel additional reward costs. As a result, the hotel needs to balance these factors, including market situation, operating costs, emission costs, cost saving, and reward costs.

Table 6. Price comparison.

Circumstances	Comparison Results
Case-PE vs. Case-I	
$\Delta p_{BS}^{PE} = p_{PE}^{A*} - p_2^{A*}$ $\Delta p_{MS}^{PE} = p_{PE}^{O*} - p_2^{A*}$ $\Delta p_{GS}^{PE} = p_{PE}^{O*} - p_2^{O*}$	$= 0$ $= \frac{[b(1-2Q)-c+v-c_E(1-r_L)]}{2} \geq 0$ $= \frac{[(1-b)(2Q-1)+v+c_E r_L]}{2} > 0$
Case-FE vs. Case-I	
$\Delta p_{BS}^{FE} = p_{FE}^{A*} - p_2^{A*}$ $\Delta p_{MS}^{FE} = p_{FE}^{A*} - p_2^{O*}$ $\Delta p_{GS}^{FE} = p_{FE}^{O*} - p_2^{O*}$	$= \frac{1-b-v-c_E r_L}{2} \leq 0$ $= \frac{1-c-c_E-2bQ}{2} \gtreqless 0$ if and only if $b \lesseqgtr \frac{1-c-c_E}{2Q}$ $= Q(1-b) > 0$

The hotel can increase room prices when all rooms are occupied for Case-PE. In MS, the higher price and room occupancy in Case-PE result in higher profits. In GS, the hotel is fully occupied for both Case-FE and Case-I. Thus, the higher prices for Case-FE also result in higher profits.

4.3.2. Case-FE

Table 6 indicates that the room price of Case-FE is lower than Case-I in BS (i.e., $\Delta p_{BS}^{FE} \leq 0$), whereas the results are the opposite in GS (i.e., $\Delta p_{GS}^{FE} > 0$). This suggests that if all customers staying in the hotel are I-type, the hotel should lower the room price to attract more customers in the bad market situation while raising it in the good market situation. Significantly, all customers participating in carbon reduction can help the hotel to save many costs, which makes it possible for the hotel to lower the price, thus attracting more customers. In BS, the lower room price for Case-FE leads to higher occupancy than Case-I, thus bringing higher profits. In GS, the hotel is fully occupied in both Case-FE and Case-I. Therefore, the hotel has an opportunity to raise room prices to maximize profits as much as possible. The higher prices for Case-FE result in higher profits.

Regarding MS, the room price of Case-FE is higher than Case-I when the customer-perceived sacrifice is too great, i.e., $\Delta p_{MS}^{FE} > 0$ if $b < \frac{1-c-c_E}{2Q}$, and vice versa, i.e., $\Delta p_{MS}^{FE} < 0$ if $b > \frac{1-c-c_E}{2Q}$. This is because of the positive relationship between customer-perceived sacrifice, discounting, and pricing (see Propositions 2(b) and 3(b)). Specifically, if the perceived sacrifice by customers is significant, the hotel would offer more discounts to customers to improve customer satisfaction in Case-FE, which would increase the reward expenditures of the hotel, thus resulting in a price increase, and vice versa. Notably, $\frac{1-c-c_E}{2Q}$ represents half of the profit per room. Therefore, it is inferred that, besides customer-perceived experience sacrifice, the profit margin can also affect hotel pricing when the market is moderate.

4.4. Performance in Carbon Reduction

Table 7 shows the emission comparison. In GS, the hotel is fully occupied, as there is customer participation in carbon reduction for Case-E, resulting in lower carbon emissions than Case-I, i.e., $\Delta E_{GS}^{PE} < 0$ and $\Delta E_{GS}^{FE} < 0$.

Table 7. Emission comparisons.

Circumstances	Comparison Results	Post Hoc
Case-PE vs. Case-I		
$\Delta E_{BS}^{PE} = E_{T,PE}^{A*} - E_{T,2}^{A*}$	$= \frac{(1-b-r_L)[v-c(1-b)-c_E(1-b-r_L)]}{2b(1-b)}$	$\gtreqless 0 \Leftrightarrow r_L \lesseqgtr 1-b$
$\Delta E_{MS}^{PE} = E_{T,PE}^{O*} - E_{T,2}^{A*}$	$= \frac{1}{2}\left[2Q - (1-c-c_E) - \frac{r_L[(1-b)(2Q-1)+v+c_E r_L]}{1-b}\right]$	• If $r_L \geq 1-b$, $E_{T,1}^{P*} \leq E_{T,2}^{O*}$; • If $r_L < 1-b$, $E_{T,1}^{P*} \gtrless E_{T,2}^{O*} \Leftrightarrow Q \gtrless \frac{(1-b)(1-c-c_E)-r_L(1-b-c_E r_L-v)}{2(1-b)(1-r_L)}$.
$\Delta E_{GS}^{PE} = E_{T,PE}^{O*} - E_{T,2}^{O*}$	$= -\frac{r_L[(1-b)(2Q-1)+v+c_E r_L]}{2(1-b)}$	< 0
Case-FE vs. Case-I		
$\Delta E_{BS}^{FE} = E_{T,FE}^{A*} - E_{T,2}^{A*}$	$= \frac{(c+c_E-r_L)b+(1-r_L)[v-c-c_E(1-r_L)]}{2b}$	• If $r_L \geq c+c_E$, $E_{T,1}^{O*} < E_{T,2}^{O*}$; • If $r_L < c+c_E$, $E_{T,1}^{O*} \gtrless E_{T,2}^{O*} \Leftrightarrow b \gtrless \frac{(1-r_L)[c-v+c_E(1-r_L)]}{c+c_E-r_L}$.
$\Delta E_{MS}^{FE} = E_{T,FE}^{O*} - E_{T,2}^{A*}$	$= Q(1-r_L) - \frac{1-c-c_E}{2}$	• If $r_L > c+c_E$, $E_{T,1}^{P*} \gtrless E_{T,2}^{O*} \Leftrightarrow Q \gtrless \frac{1-c-c_E}{2(1-r_L)}$; • If $r_L = c+c_E$, $E_{T,1}^{P*} < E_{T,2}^{O*}$; • If $r_L < c+c_E$, $E_{T,1}^{P*} \leq E_{T,2}^{O*}$ for $b \geq \frac{(1-r_L)[c-v+c_E(1-r_L)]}{c+c_E-r_L}$; and $E_{T,1}^{P*} \gtrless E_{T,2}^{O*} \Leftrightarrow Q \gtrless \frac{1-c-c_E}{2(1-r_L)}$, for $b < \frac{(1-r_L)[c-v+c_E(1-r_L)]}{c+c_E-r_L}$.
$\Delta E_{GS}^{FE} = E_{T,FE}^{O*} - E_{T,2}^{O*}$	$= -Qr_L$	< 0

However, in BS and MS, the total carbon emissions in Case-E are sometimes lower than in Case-I. The most critical factor influencing the carbon reduction performance of discount incentives is the per-room carbon emission reduction (r_L). Specifically, if r_L is large, even if higher occupancy is induced by the discount incentive (see Table 5), the total carbon emissions of the hotel still decrease. The threshold of a sufficiently large r_L depends on the effectiveness of the discount incentive. Therefore, this study suggests Proposition 5.

Proposition 5. *In Case-PE, the discount incentive reduces the total carbon emissions of the hotel if the average reduced carbon emissions per room due to customer participation are more significant than the customer-perceived experience sacrifice (i.e.,* $r_L > 1-b$*).*

For a small $r_L \leq 1-b$, the discount incentive always increases the hotel's total carbon emissions in BS because the carbon reductions per room does not compensate for the increase in carbon emissions due to higher occupancy. Meanwhile, in MS, the hotel's total carbon emissions may be reduced when the number of available rooms (Q) is relatively small. When Q is small, the increase in carbon emissions due to higher occupancy is limited. Thus, even though the carbon emission reductions per room are slight, the accumulated carbon reduction in each room is still more than the increased carbon emissions generated by higher occupancy.

In Case-FE, the conditions for carbon reduction are far more complex. Specifically, the discount incentive always reduces carbon emissions in BS for $r_L > c + c_E$. For a small $r_L \leq c + c_E$, the discount incentive can reduce carbon emissions when b is small too. In MS, for a large $r_L > c + c_E$, Q should be small, too, for carbon reduction. However, the discount incentive always reduces the total carbon emissions when $r_L = c + c_E$. For a small $r_L < c + c_E$, the discount incentive always reduces the total carbon emissions when b is relatively large. However, Q must be relatively minor, too, for carbon reduction when b is relatively small. All of these results show the complex interactions between the optimal price and discount of the hotel and the associated occupancy.

5. Findings and Discussion

Inspired by the indulgent nature of tourism, this study adopts revenue management pricing to investigate the effect of cash discounts on green customer behavior for participating in hotel carbon reduction from an egoistic values perspective. Our study concluded that discount incentives promote customer participation in hotel carbon reduction only when cash discounts are no less than the customer-perceived value sacrificed for the hotel (Proposition 1). This is because the primary purpose of customers staying in hotels is to pursue hedonism and thus balance the benefits and sacrifices of participating in environmental activities [14,21,31–33].

Further, the study observed that the relationship between customer-perceived experience sacrifice and (the proportion of) cost saved due to carbon reduction affects the effectiveness (i.e., ineffective, partially effective, or fully effective) of discount incentives (Proposition 4). "Partially effective" means that some customers are still reluctant to participate in hotel carbon reduction under discount incentives, while "fully effective" denotes that all customers would participate. Notably, the finding (Proposition 4(c)) suggests that one of the reasons why discount incentives are usually partially effective should be that customers always believe that participating in emission reduction can save the hotel far more costs than their own (i.e., perceived experience sacrifice). Savvy customers believe that participating in green practices can save hotels significant costs [34,40,41]. Egoistic values emphasize maximizing individual outcomes rather than advocating concern for the welfare of others [49].

Additionally, this study suggests that effective discount incentives always help to increase hotel profits and occupancy. However, whether these incentives can help to reduce carbon emissions depends on various factors. These factors vary according to the discount incentive effectiveness (i.e., partially or fully effective) and the market situation. Therefore, it can be inferred that once a hotel is profit-oriented, carbon reduction involving high operational costs always benefits the hotel economically [6,34,41], but the ability to reduce environmental damage is uncertain.

Specifically, no matter whether partially or fully effective, discount incentives will help to reduce the hotel's total carbon emissions if the market situation is good. However, if the market is moderate or bad and discount incentives are partially effective, whether these incentives can help to reduce total carbon emissions depends on the relationship between carbon reductions per room and customer-perceived experience sacrifice (see Proposition 5 and Table 7). This finding implies that once the planned carbon reduction in each room is fixed, the less the customer-perceived experience sacrifice, and the more likely that the hotel's total carbon emissions will be reduced due to the effective discount incentives. Otherwise, with the fixed carbon reductions per room, the greater experience sacrifice perceived by customers will be more likely to lead to more total carbon emissions in the bad market situation, where the hotel is not full regardless of the discount incentives' effectiveness. This is due to the positive relationship between customer-perceived experience sacrifice, discount, occupancy, and total carbon emissions. Nevertheless, in a moderate market situation, where the hotel is not full without a discount incentive while fully occupied with an effective discount incentive, the discount incentive can lower the total carbon emissions only when the hotel capacity is relatively small. This is because the increased carbon emissions due to higher occupancy are limited and less than the accumulated carbon reduction in all of the rooms.

Differently, for the fully effective discount incentives, whether customer-perceived experience sacrifice and the number of available rooms could affect the carbon reduction performance of discount incentives depends on the relationship between carbon reduction and total costs, including operation costs and emission costs (see Table 7). Furthermore, the relationship between these four factors varies according to market situations. For instance, in a bad market situation, the fully effective discount incentive only lowers carbon emissions if the carbon reductions per room is more significant than the total costs per room, or if the carbon reductions per room is smaller than the total costs but the customer-perceived experience sacrifice is great. Regarding the moderate market situation, the hotel's capacity can, together with the above factors, affect the carbon reduction performance of the fully effective discount incentive.

6. Conclusions and Future Research

In the context of hotel carbon reduction, this study investigated the effectiveness of cash discount incentives in promoting green customer behavior. The study concluded that customer-perceived sacrifice for a green hotel moderates the efficacy of cash discount incentives. Furthermore, (the proportion of) total costs saved due to carbon reduction can influence this moderating effect. In addition, based on the optimal pricing and/or discounting decisions of a green hotel, this study found that effective cash discount incentives always help to improve the profit and occupancy of a green hotel. In contrast, they may not necessarily reduce the total carbon emissions of the green hotel, that is, due to the complexity and interactions of the factors that affect the total carbon emissions of a green hotel. These factors include customer-perceived experience sacrifice, effectiveness (partially or fully effective) of discount incentives, market situation, carbon reductions per room, occupancy, operating and emission costs, discounting, and pricing. Our findings provide implications for scholars investigating the impact of cash discount incentives on green customer behavior (Section 6.1) and hotels implementing cash discount incentives (Section 6.2). Further, they can be extended to future research to advance the theoretical understanding of the impacts of discount incentives on green customer behavior and hotel performance in the context of carbon reduction.

6.1. Theoretical Implications

Consistent with prior studies [36–38], the current study confirms that cash discounts can trigger green customer behavior. However, different from the previous literature, our study found that it is conditional for this discount incentive to do this, which explains why some of the customers staying in a green hotel may appear to be green under the cash discount incentive while the remaining customers may not [34,36,37]. From the perspective of egoistic values, this study is the first to prove that only when cash discounts are higher than the sacrifice value perceived by customers, do these customers behave in a green way under the discount incentives. This conclusion establishes a theoretical foundation for the associated research, such as reasons for the customer environmental attitude–behavior gap, which can be further confirmed in future research.

This study is also the first to systematically and comprehensively derive the conditions for ineffective, partially effective, or fully effective discount incentives. These conditions provide some of the reasons why cash discount incentives are usually ineffective or partially effective in reality. The associated results indicate that the balance between customer-perceived experience sacrifice and (proportion of) total costs saved owing to green practice (carbon reduction) significantly impacts the effectiveness of cash discount incentives. That is to say, the impacts of a hotel's environmental motivation and the hedonic nature of tourism on green customer behavior should not be ignored [6,21,31,32,34]. Our findings provide theoretical implications for this line of research.

Finally, yet importantly, this study proposes a comprehensive and integrative framework, incorporating environmental values, green customer behavior, revenue management, green practice (carbon reduction), and incentive mechanism. The findings of the study enrich the literature in the associated areas. For instance, this study is among the sparse literature regarding the impacts of egoistic values on green customer behavior [49], which initially combined the "Value–Attitude–Behavior" theory and revenue management theory to research the optimal pricing and discounting under cash discount incentives. Notably, our findings indicate that customer-perceived value sacrificed for a green hotel could affect the effectiveness of discount incentives, thus affecting the hotel's optimal room price and discount. More importantly, this study also confirmed that when hotels prioritize profitability, effective discount incentives always help to increase room profits but may not necessarily reduce total carbon emissions. These findings provide directions for future research on the related topics.

6.2. Managerial Implications

The findings provide practical implications for green hotels to make discount incentive decisions in promoting green customer behavior.

First, hotels should consider reducing customer-perceived experience sacrifice (e.g., inconvenience, lesser quality, or less luxury) when implementing discount incentives in carbon reduction. Our study suggests that customers will participate in carbon reduction only when cash discounts exceed the customer-perceived sacrifice value for the hotel (Proposition 1). The lighter the customer-perceived sacrifice, the more likely it is that the discount incentive will be effective. In addition, the current study argues that the customer-perceived sacrifice for the hotel positively affects the optimal discounts (Proposition 2). This means that the greater the customer-perceived sacrifice, the higher the discount that the hotel should provide. However, providing discounts to customers would increase the hotel's expenditures. Thus, to cut costs brought by reward expenditures, the hotel should find ways to reduce customer-perceived sacrifice, such as improving the service quality. For example, a hotel can use refillable toiletries instead of canceling the original disposable toiletries. Another example is that the hotel can help to wash and iron the customers' clothes so that customers would be willing to reuse bed sheets [34].

Second, to implement effective discount incentives, whether the hotel must increase room prices to compensate for reward expenditures depends on the market situation and the effectiveness of this incentive. The hotel can increase room prices if it is in a sufficiently good market situation (i.e., the peak season, regardless of the effectiveness of discount incentives). On the contrary, the hotel should not raise prices if the market situation is poor. Further, if the market is bad, the hotel may even need to lower prices to attract more occupancy if the hotel would like to attract all customers to participate in carbon reduction (i.e., fully effective discount incentives). Notably, when cash discount incentives are usually partially effective (i.e., some customers are still reluctant to behave in a green way in the hotel context), raising room prices may be a better choice for hotels than lowering prices during the peak season of implementing discount incentives. Indeed, the previous literature has suggested that some eco-conscious customers might be willing to pay extra for green hotel practices [33,53]. Kim et al. [75] revealed that about 50% of US customers are willing to pay over 3% extra for green activities in the hospitality industry.

Third, as observed, effective cash discount incentives may not necessarily reduce the total carbon emissions of a hotel. Thus, how to find ways to reduce total carbon emissions as much as possible should be a consideration for the hotel when implementing these incentives. Besides customer-perceived experience sacrifice, our findings imply that carbon reductions per room and occupancy can also affect the carbon reduction performance of discount incentives. The more significant the carbon reductions per room, the more likely it is that the hotel will achieve good carbon reduction performance. As is well known, a green practice type can affect carbon reductions per room. Thus, how to choose the types of green practices that customers will participate in, or combining these types, should be considerations for hotels when implementing discount incentives.

6.3. Limitations and Future Research

As there are some assumptions in our models, the conclusions of this study are only applicable under certain conditions. Future research can be conducted by relaxing the assumptions to further confirm this study's findings. For example, our model assumes that the decision objective of the hotel is to maximize profits. To retest the impacts of discount incentives on the total carbon emissions of the hotel and characterize the hotel's social responsibility, extended models can consider double decision-making objectives (i.e., profit maximization and emission minimization). Another example is that this study assumed that room price and discount are decision variables of the hotel. Future research can consider other decision variables, such as the number of rooms occupied by customers. Additionally, the study assumed that the average reduced units of carbon emissions per room are an exogenous variable. However, this may be affected by customer-perceived sacrifice, which future research should consider.

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References

1. Aboelmaged, M. Direct and indirect effects of eco-innovation, environmental orientation and supplier collaboration on hotel performance: An empirical study. *J. Clean. Prod.* **2018**, *184*, 537–549. [CrossRef]
2. Nimri, R.; Patiar, A.; Jin, X. The determinants of consumers' intention of purchasing green hotel accommodation: Extending the theory of planned behaviour. *J. Hosp. Tour. Manag.* **2020**, *45*, 535–543. [CrossRef]
3. Denton, G.; Chi, O.H.; Gursoy, D. An examination of the gap between carbon offsetting attitudes and behaviors: Role of knowledge, credibility and trust. *Int. J. Hosp. Manag.* **2020**, *90*, 102608. [CrossRef]
4. Denton, G.; Chi, H.; Gursoy, D. An examination of critical determinants of carbon offsetting attitudes: The role of gender. *J. Sustain. Tour.* **2020**, *30*, 1539–1561. [CrossRef]
5. Gössling, S.; Scott, D. The decarbonisation impasse: Global tourism leaders' views on climate change mitigation. *J. Sustain. Tour.* **2018**, *26*, 2071–2086. [CrossRef]
6. Gupta, A.; Dash, S.; Mishra, A. Self/other oriented green experiential values: Measurement and impact on hotel-consumer relationship. *Int. J. Hosp. Manag.* **2019**, *83*, 159–168. [CrossRef]
7. Kim, M. A systematic literature review of the personal value orientation construct in hospitality and tourism literature. *Int. J. Hosp. Manag.* **2020**, *89*, 102572. [CrossRef]
8. Sadiq, M.; Paul, J.; Bharti, K. Dispositional traits and organic food consumption. *J. Clean. Prod.* **2020**, *266*, 121961. [CrossRef]
9. Statista. Share of Global Travelers That Want to Use Green Lodging in the Next Year 2016–2022. Available online: https://www.statista.com/statistics/1055777/sustainable-travel-travelers-staying-in-green-lodging-in-the-next-year/ (accessed on 21 October 2022).
10. Yadav, R.; Balaji, M.S.; Jebarajakirthy, C. How psychological and contextual factors contribute to travelers' propensity to choose green hotels? *Int. J. Hosp. Manag.* **2019**, *77*, 385–395. [CrossRef]
11. Han, H. Theory of green purchase behavior (TGPB): A new theory for sustainable consumption of green hotel and green restaurant products. *Bus. Strategy Environ.* **2020**, *29*, 2815–2828. [CrossRef]
12. Merli, R.; Preziosia, M.; Acamporaa, A.; Ali, F. Why should hotels go green? Insights from guests experience in green hotels. *Int. J. Hosp. Manag.* **2019**, *81*, 169–179. [CrossRef]
13. Verma, V.K.; Chandra, B.; Kumar, S. Values and ascribed responsibility to predict consumers' attitude and concern towards green hotel visit intention. *J. Bus. Res.* **2019**, *96*, 206–216. [CrossRef]
14. Yu, Y.; Li, X.; Jai, T.M. The impact of green experience on customer-satisfaction: Evidence from TripAdvisor. *Int. J. Contemp. Hosp. Manag.* **2017**, *29*, 1340–1361. [CrossRef]

15. TTG China. Booking.com Provides a 2.6 Million Euro Fund to Fully Support Sustainable Accommodation and Tourism Development. Available online: https://ttgchina.com/2020/02/12/ (accessed on 12 February 2020).
16. TTG China. Booking.com Launches the "Sustainable Travel" Logo to Display the "Green" Accommodation Label. Available online: https://ttgchina.com/2021/11/22/ (accessed on 22 November 2021).
17. Chinadaily. Booking.com Releases 2023 Sustainable Travel Report: Highlighting the Dilemma of Environmental Awareness and Consumer Costs. Available online: http://ex.chinadaily.com.cn/exchange/partners/82/rss/channel/cn/columns/sz8srm/stories/WS6461fa85a310537989374391.html (accessed on 15 May 2023).
18. Booking.com. Our Shared Journey Starts by Showcasing Our Partners' Sustainability Practices. Available online: https://www.sustainability.booking.com/booking-travel-sustainable (accessed on 18 July 2023).
19. Dimara, E.; Manganari, E.; Skuras, D. Don't change my towels please: Factors influencing participation in towel reused programs. *Tour. Manag.* **2017**, *59*, 425–437. [CrossRef]
20. Green Lodging Calculator. Available online: https://www.greenlodgingcalculator.org/ (accessed on 27 April 2016).
21. Han, H.; Hyun, S.S. What influences water conservation and towel reuse practices of hotel guests? *Tour. Manag.* **2018**, *64*, 87–97. [CrossRef]
22. Mechri, H.E.; Amara, S. Investigation and analysis of energy and water use of hotel buildings in Tunisia. *Energy Build.* **2021**, *241*, 110930. [CrossRef]
23. Untaru, E.; Ispas, A.; Candrea, A.N.; Luca, M.; Epuran, G. Predictors of individuals' intention to conserve water in a lodging context: The application of an extended theory of reasoned action. *Int. J. Hosp. Manag.* **2016**, *59*, 50–59. [CrossRef]
24. Untaru, E.N.; Ispas, A.; Han, H. Exploring the synergy between customer home-based and hotel-based water consumption and conservation behaviors: An empirical approach. *J. Consum. Behav.* **2020**, *19*, 542–555. [CrossRef]
25. Warren, S.; Beckon, S.; Coghlan, A. Using persuasive communication to co-create behavioural change—Engaging with guests to save resources at tourist accommodation facilities. *J. Sustain. Tour.* **2017**, *25*, 935–954. [CrossRef]
26. Dolnicar, S.; Cvelbar, L.K.; Grün, B. A sharing-based approach to enticing tourists to behave more environmentally friendly. *J. Tour. Res.* **2019**, *58*, 241–252. [CrossRef]
27. Han, H.; Chua, B.L.; Hyun, S.S. Eliciting customers' waste reduction and water saving behaviors at a hotel. *Int. J. Hosp. Manag.* **2020**, *87*, 102386. [CrossRef]
28. Segerstedt, A.; Grote, U. Increasing adoption of voluntary carbon offsets among tourists. *J. Sustain. Tour.* **2016**, *24*, 1541–1554. [CrossRef]
29. Agag, G.; Colmekcioglu, N. Understanding guests' behavior to visit green hotels: The role of ethical ideology and religiosity. *Int. J. Hosp. Manag.* **2020**, *91*, 102679. [CrossRef]
30. Eid, R.; Agag, G.; Shehawy, Y.M. Understanding guests' intention to visit green hotels. *J. Hosp. Tour. Res.* **2020**, *45*, 494–528. [CrossRef]
31. Higham, J.; Reis, A.; Cohen, S.A. Australian climate concern and the "attitude–behaviour gap". *Cur. Issues Tour.* **2016**, *19*, 338–354. [CrossRef]
32. Holmes, M.R.; Dodds, R.; Frochot, I. At home or abroad, does our behavior change? Examining how everyday behavior influences sustainable travel behavior and tourist clusters. *J. Travel Res.* **2021**, *60*, 102–116. [CrossRef]
33. Rahman, I.; Reynolds, D. Predicting green hotel behavioral intentions using a theory of environmental commitment and sacrifice for the environment. *Int. J. Hosp. Manag.* **2016**, *52*, 107–116. [CrossRef]
34. Huang, H.C.; Lin, T.H.; Lai, M.C.; Lin, T.L. Environmental consciousness and green customer behavior: An examination of motivation crowding effect. *Int. J. Hosp. Manag.* **2014**, *40*, 139–149. [CrossRef]
35. Young, W.; Hwang, K.; McDonald, S.; Oates, C.J. Sustainable consumption: Green consumer behaviour when purchasing products. *Sustain. Dev.* **2010**, *18*, 20–31. [CrossRef]
36. Berezan, O.; Millar, M.; Raab, C. Sustainable hotel practices and customer satisfaction levels. *Int. J. Hosp. Tour. Adm.* **2014**, *15*, 1–18.
37. Ting, C.T.; Hsieh, C.M.; Chang, H.P.; Chen, H.S. Environmental Consciousness and Green Customer Behavior: The Moderating Roles of Incentive Mechanisms. *Sustainability* **2019**, *11*, 819. [CrossRef]
38. Frey, B.S.; Jegen, R. Motivation crowding theory: A survey of empirical evidence. *J. Econ. Sur.* **2001**, *15*, 589–611. [CrossRef]
39. Krakovsky, M. Less wash, more dry: For hotel towel reuse, social pressure beats green values. *Sci. Ameri* **2008**, *299*, 28–29. [CrossRef] [PubMed]
40. Rahman, I.; Park, J.; Chi, C.G. Consequences of "greenwashing": Consumers' reactions to hotels' green initiatives. *Int. J. Contemp. Hosp. Manag.* **2014**, *27*, 1055–1081. [CrossRef]
41. Yin, C.Y.; Du, F.; Chen, Y. Types of green practices, hotel price image and consumers' attitudes in China: The mediating role of consumer skepticism. *J. Hosp. Mark. Manag.* **2020**, *29*, 329–357. [CrossRef]
42. Homer, P.M.; Kahle, L.R. A structural equation test of the value-attitude-behavior hierarchy. *J. Personal. Soc. Psychol.* **1988**, *54*, 638. [CrossRef]
43. Sadiq, M.; Adil, M.; Paul, J. Eco-friendly hotel stay and environmental attitude: A value-attitude-behaviour perspective. *Int. J. Hosp. Manag.* **2022**, *100*, 103094. [CrossRef]
44. Shin, Y.H.; Moon, H.; Jung, S.E.; Severt, K. The effect of environmental values and attitudes on consumer willingness to pay more for organic menus: A value-attitude-behavior approach. *J. Hosp. Tour. Manag.* **2017**, *33*, 113–121. [CrossRef]

45. Tanford, S.; Malek, K. Segmentation of reward program members to increase customer loyalty: The role of attitudes towards green hotel practices. *J. Hosp. Mark. Manag.* **2015**, *24*, 314–343. [CrossRef]
46. Shoemaker, S.; Lewis, R.C. Customer loyalty: The future of hospitality marketing. *Int. J. Hosp. Manag.* **1999**, *18*, 345–370. [CrossRef]
47. Schwartz, S.H. Universals in the content and structure of values: Theoretical advances and empirical tests in 20 countries. In *Advances in Experimental Social Psychology*; Academic Press: Cambridge, MA, USA, 1992; Volume 25, pp. 1–65.
48. Stern, P.C. New environmental theories: Toward a coherent theory of environmentally significant behavior. *J. Soc. Issues* **2000**, *56*, 407–424. [CrossRef]
49. Rahman, I.; Reynolds, D. The influence of values and attitudes on green consumer behavior: A conceptual model of green hotel patronage. *Int. J. Hosp. Tour. Adm.* **2019**, *20*, 47–74. [CrossRef]
50. Nair, G.K. Dynamics of pricing and non-pricing strategies, revenue management performance and competitive advantage in hotel industry. *Int. J. Hosp. Manag.* **2019**, *82*, 287–297. [CrossRef]
51. Xu, X.; Xiao, G.; Gursoy, D. Maximizing profits through optimal pricing and sustainability strategies: A joint optimization approach. *J. Hosp. Mark. Manag.* **2017**, *26*, 395–415. [CrossRef]
52. Cui, Y.; Duenyas, I.; Sahin, O. Pricing of conditional upgrades in the presence of strategic consumers. *Manag. Sci.* **2018**, *64*, 3208–3226. [CrossRef]
53. González-Rodríguez, M.R.; Díaz-Fernández, M.C.; Font, X. Factors influencing willingness of customers of environmentally friendly hotels to pay a price premium. *Int. J. Contemp. Hosp. Manag.* **2020**, *32*, 60–80. [CrossRef]
54. Ponnapureddy, S.; Priskin, J.; Ohnmacht, T.; Vinzenz, F.; Wirth, W. The influence of trust perceptions on German tourists' intention to book a sustainable hotel: A new approach to analysing marketing information. *J. Sustain. Tour.* **2017**, *25*, 970–988. [CrossRef]
55. Green Hotel Association. What Are Green Hotels? Available online: http://greenhotels.com/index.php (accessed on 8 August 2023).
56. Chan, M.K.M.; Tsang, N.K.F.; AU, W.C.W. Effective approaches for encouraging hotel guests' voluntary bedding linen reuse behavior. *Int. J. Hosp. Manag.* **2022**, *101*, 103105. [CrossRef]
57. Frey, B.S.; Oberholzer-Gee, F. The cost of price incentives: An empirical analysis of motivation crowding-out. *Ameri Econ. Rev.* **1997**, *87*, 746–755.
58. Tajfel, H.; Turner, J. *The Social Identity Theory of Intergroup Behaviour. u: Worchel S. i Austin WG (ur.) Psychology of Intergroup Relations*; Nelson Hall: Chicago, IL, USA, 1986.
59. Kautish, P.; Sharma, R. Value orientation, green attitude and green behavioral intentions: An empirical investigation among young consumers. *Young Consum.* **2019**, *20*, 338–358. [CrossRef]
60. De Groot, J.I.; Steg, L. Value orientations to explain beliefs related to environmental significant behavior how to measure egoistic, altruistic, and biospheric value orientations. *Environ. Behav.* **2008**, *40*, 330–354. [CrossRef]
61. Van Lange, P.A.; Agnew, C.R.; Harinck, F.; Steemers, G.E. From game theory to real life: How social value orientation affects willingness to sacrifice in ongoing close relationships. *J. Personal. Soc. Psychol.* **1997**, *73*, 1330. [CrossRef]
62. Davis, J.L.; Le, B.; Coy, A.E. Building a model of commitment to the natural environment to predict ecological behavior and willingness to sacrifice. *J. Environ. Psychol.* **2011**, *31*, 257–265. [CrossRef]
63. Han, X.; Chan, K. Perception of green hotels among tourists in Hong Kong: An exploratory study. *Serv. Mark. Q.* **2013**, *34*, 339–352. [CrossRef]
64. Kimes, S.E. Yield Management: A tool for capacity-constrained service firms. *J. Oper. Manag.* **1989**, *8*, 348–363. [CrossRef]
65. Ampountolas, A.; Shaw, G.; James, S. Examining the relationships between market indicators and hotel pricing approaches. *Tour. Econ.* **2021**, *27*, 1591–1614. [CrossRef]
66. Mateos, D.L.; Cohen, M.C.; Pyron, N. Field Experiments for Testing Revenue Strategies in the Hospitality Industry. *Cornell Hosp. Q.* **2022**, *63*, 247–256. [CrossRef]
67. Abrate, G.; Nicolau, J.L.; Viglia, G. The impact of dynamic price variability on revenue maximization. *Tour. Manag.* **2019**, *74*, 224–233. [CrossRef]
68. Hu, T.; Song, H. Analysis of influencing factors and distribution simulation of budget hotel room pricing based on big data and machine learning from a spatial perspective. *Sustainability* **2023**, *15*, 617. [CrossRef]
69. Dong, Y.; Ling, L. Hotel overbooking and cooperation with third-party websites. *Sustainability* **2015**, *7*, 11696–11712. [CrossRef]
70. Ivanov, S. *Hotel Revenue Management: From Theory to Practice*; Zangador Publishing: Varna, Bulgaria, 2014.
71. Asadi, S.; Pourhashemi, S.O.; Nilashi, M.; Abdullah, R.; Samad, S.; Yadegaridehkordi, E.; Aljojo, N.; Razali, N.S. Investigating influence of green innovation on sustainability performance: A case on Malaysian hotel industry. *J. Clean. Prod.* **2020**, *258*, 120860. [CrossRef]
72. Cvelbar, L.K.; Grün, B.; Dolnicar, S. Which hotel guest segments reuse towels? Selling sustainable tourism services through target marketing. *J. Sustain. Tour.* **2017**, *25*, 921–934. [CrossRef]
73. Lin, P.C.; Huang, Y.H. The influence factors on choice behavior regarding green products based on the theory of consumption values. *J. Clean. Prod.* **2012**, *22*, 11–18. [CrossRef]

74. Shen, B.; Dong, C.W.; Minner, S. Combating Copycats in the Supply Chain with Permissioned Blockchain Technology. *Prod. Oper. Manag.* **2022**, *31*, 138–154. [CrossRef]
75. Kim, S.; Yoon, J.; Shin, J. Sustainable business-and-industry foodservice. *Int. J. Contemp. Hosp. Manag.* **2015**, *27*, 648–669. [CrossRef]