


Article

# Price Risk Strategy Analysis for Budget Hotels in the Post-Pandemic Era

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**Abstract:** The supply chain of the tourism industry, including air transportation, travel agencies, souvenirs, and hotel services, is almost at a breaking point, causing a rise in unemployment with huge losses during the COVID-19 pandemic period. In order to overcome these losses, we propose that luxury hotels should consider offering budget hotels at a lower cost but with satisfactory accommodation in order to create some turn-arounds in the post-pandemic era. However, budget hotels that branch off from luxury hotels cannot post the same room rates because there are some uncertain factors that affect the traveler experience when staying in budget hotels. In this study, we define four types of risk factors for the self-selection of the consumer model, and then find that the optimal room price appears to be independent of the performance risk for the service quality, brand image, and shuttle buses, but is dependent on physical risk in terms of priority number risk, the financial risk of refund rates, and the privacy risk of investment in the system. Finally, we discuss how government subsidies can encourage branched budget hotels by describing three sensitivity scenarios. The results show that subsidies that go towards staff training and higher-frequency shuttle buses will cause consumers to book more stays in budget hotels and, thereby, contribute to a higher profit. By lobbying the policy on government subsidies, budget hotels that branch off from luxury hotels are a profitable business model for a reduction in the huge losses occurred during the period of the spread of COVID-19.



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**MSC:** 62C05; 90B50; 90C31

## 1. Introduction

The hotel industry has played an important role in many countries in which the tourism industry has become well developed. However, the COVID-19 epidemic continues to be serious, and most countries have gone into lockdown, thereby making it difficult for international tourists to travel for long times and long distances since the end of 2019. Due to the huge losses, some luxury hotels have stopped their operations, transforming into quarantine or budget hotels. Now, more countries are gradually lifting their lockdowns because the World Health Organization (WHO) has announced the gradually lightened waves of infections. Therefore, most luxury hotels should try to prepare for the renewed interest in traveling by different segments of consumers. The main target group of budget hotels is that of budget-conscious customers who are concerned about how much a room costs because they have a limited amount of money to spend when they travel. Tourists who would like to save their expenses visit what are defined as budget hotels, which have a small number of rooms and much lower service and facility costs [1,2]. Albattat and Amer [3] described most of the complaints that many budget hotels have encountered, including unclean and uncomfortable rooms, no hot water, rude staff, and bad food because of the lack of resources and good service management. Rude employees can be found in both luxury and budget hotels throughout the world, but they can most often be found in cheap hotels

because their staff are untrained and are not qualified for their jobs [4]. As the tourism and hospitality industry in Taiwan has continuously grown, many budget hotels have focused on targeting tourists who are traveling with a limited budget. There are some challenges that budget hotels face when compared to luxurious hotels. First, some staff may lack well-trained service skills, and/or facilities offered to tourists may not be much compared to those of a luxury hotel. Second, the other challenges are characterized as seasonality, terrorism, floating exchange rates, and the infectious disease COVID-19, which has led to changing customer demands [5–8]. Customers are concerned about risk and distrust when using these services, which causes uncertainty or expectations around them [9]. Risk is viewed in terms of potential loss. Therefore, researchers have suggested that an awareness of the perceived risk will allow an accommodation provider to reduce the likelihood of loss and turn it into guest satisfaction [10]. Some studies have looked at risks with tourism and tried to reflect the impacts that they had on the tourism industry. For example, in 2020, the tourism industry was directly impacted by COVID-19, resulting in a lack of income from international and domestic travelers in certain areas [11]. In risk analysis, some popular types are used to explain perceived risk. First, in the situation of COVID-19, physical risk [12,13] is an uncontrollable risk whereby the viral epidemic has halted tourism, and tourists are unable to travel to various destinations, thus causing a loss of income from this situation [11]. Second, financial risk concerns the value of the price paid or guaranteed for the refund of an accommodation in the event of an emergency [13,14]. Third, privacy risk refers to the privacy of any personal information or financial transaction information of customers using the accommodation [15]. The sharing of personal information via online platforms continues to raise privacy concerns. Customers will inevitably be concerned about the disclosure of such information when filling out personal information, including payment information [16]. Reducing privacy risks during online transactions can increase the confidence of service customers; research showed that they would be trustful and confident when coming back to use the service again [17]. Fourth, performance risk is a service risk that customers encounter when services might not meet their expectations or satisfy them [18]. When comparing standards of services and facilities of budget hotels with those of other accommodations, the services and amenities of budget hotels are much worse than those of others [19,20].

In order to show the pricing gap between budget hotels and luxury hotels, we assume that a traveler's utility perception of a budget hotel is affected by four types of risk factors. In the self-selection of the consumer model, the pricing gap between a customer's willingness to pay and the posted hotel rates of budget hotels is greater than or equal to that for luxury hotels. Then, we can evaluate the impacts of four types of risk on the optimal pricing, demand, and profit, which can be used to support the market strategies of budget hotels. The definitions of the risk factors were selected from references related to the field of tourism. Specifically, we plan to examine the possible impact of transforming investment on the profits of branched budget hotels by reducing the four types of risk. This analysis is based upon the concept of the self-selection of the consumer model, which was originally developed by Mussa and Rosen [21] and later employed to model various problem settings [22,23]. If the utility of a budget hotel exceeds that of a luxury hotel, a consumer will choose the service offered by the budget hotel. An analysis of the identification of an optimal policy is then demonstrated herein. In addition, in the period of the COVID-19 epidemic, we suppose that government subsidies are necessary due to the net losses in most hotels. Therefore, the analytical model is extended to explore three possible scenarios of government subsidies, including support for subsidized staff training, support for subsidized family travel, and support for subsidized facilitation of a higher frequency of shuttle buses. Therefore, the strategies of government subsidies can be used to improve the net losses and demand for some budget hotels or to support a short-term training strategy for the staff.

This paper is organized as follows. Section 2 provides a brief review for the risk factors and formulates the consumer self-selection utility definition for the budget hotels. In

Section 3, we propose the optimization analysis for the demand of the budget hotel model based on the selected risk factors and their criteria. In Section 4, a sensitivity analysis for subsidies with regard to the demand of budget hotels is presented. Finally, the conclusion is discussed in Section 5.

## 2. Risks Affect Market Demand for Budget Hotels

In this study, we try to evaluate the market demand and pricing policy based on risk management in the market for some luxury hotels that would like to transform some of their branched hotels to be budget hotels. We, therefore, study the implications of the four types of risks that are perceived by consumers in staying at budget hotels: financial risk, privacy risk, physical risk, and performance risk. This model is based upon the concept of the self-selection of consumers [21] and later employed to model various problem settings [22,23]. If the utility from the budget hotel exceeds that from the luxury hotel, the consumer will choose the service offered by the budget hotel. Our model also covers the customer's satisfactory effects on the budget hotel so as to manage the four types of risks. An analysis of identifying an optimal policy is then demonstrated herein. Consider a general luxury hotel that would like to transform some branched hotels into budget hotels, and will need the luxury hotel business model to be partially modified in the future. We assume that the pricing gap between the budget hotels and luxury hotels is from the four types of risk factors, in which the difference between a customer's willingness to pay and the posted hotel rate in budget hotels is greater than or equal to the luxury hotels' difference, and thus, the self-selection of the consumer model can be defined as follows:

$$\theta - r_1 - r_2 - r_3 - r_4 - p \geq \theta_0 - p_0 \quad (1)$$

where the notations  $r_1$ ,  $r_2$ ,  $r_3$ , and  $r_4$  denote the physical risk, performance risk, financial risk, and privacy risk, respectively. The right-hand side of Equation (1) represents the consumer utility when using a luxury hotel service; the left-hand side is the consumer utility when choosing a budget hotel with a loss (cost) of risk. Thus, when the utility from the budget hotel is greater than, or equal to, that from the luxury hotel, the consumer is assumed to choose the service offered by the budget hotel. First, the symbols  $\theta$  and  $\theta_0$  denote the customer heterogeneities, indicating a customer's willingness to pay for the service provided by the branched budget hotel and the luxury hotel, respectively.  $\theta$  and  $\theta_0$  are supposed to be independent of each other and follow a uniform distribution on  $[0, 1]$ . This assumption of a uniform distribution for customer heterogeneity has been commonly adopted in the economics literature [21]. An extensive study on two-sided markets has also assumed a uniform distribution to signify the buyer and seller's willingness to pay for goods [24,25]. We assume that both the branched budget hotel and the luxury hotel provide a service of the same room size but with different service quality, brand image, or different frequency of the shuttle bus. Next,  $p$  is the posted price on the platform of the budget hotel, including a surcharge rate fixed by the intermediary, and  $p_0$  is the price suggested by the luxury hotel. In order to control four types of risk effects to Equation (1), we try to define the factors with respect to the four types of risk.

First, the physical risk represents the fatal issues related to the customer's lives and injuries. The Failure Mode and Effect Analysis (FMEA) considers risk components such as severity (S), occurrence (O), and detection (D), which are scaled from 0 to 1 [26]. If the effect of the degree of failure is more serious, or the degree of failure is more difficult to detect, or the probability of failure is higher, then the degree of risk is higher. Therefore, we can define this as the Risk Priority Number (RPN), which takes the occurrence of failure modes (O), the severity of failure effect (S), and the probability of not detecting the failure (D) into account as follows:

$$\text{RPN} = O \times S \times D \quad (2)$$

Therefore, we can evaluate the three components of FMEA according to the different nature of the budget hotel and define four subcomponents: quality severity, time severity,

elasticity severity, and cost severity. In addition, the degree of occurrence and difficulty of detection are also expanded in different directions. Therefore, based on the RPN, we revise the physical risk as follows:

$$\text{Physical risk} = r_1 \times \text{RPN}, 0 \leq \text{RPN} \leq 1. \quad (3)$$

Second, with respect to the research on consumers' purchase intentions for budget hotels, we explore the impact of the three factors of brand image, service quality, and better shuttle bus service. Younger travelers with a relatively lower income will choose general budget hotels instead of choosing budget hotels branched from luxury hotels. Therefore, the frequency of bus transportation may also affect the consumers' willingness to stay in budget hotels [27]. We define the performance risk that comes from an unstable or lower service quality with respect to the shuttle service between the accommodation and the airport/bus station, room service, reception, fitness or spa services, etc. In the performance risk analysis, based on previous research, the focus on the major factors that affect market demand are service quality, brand image, and shuttle bus service. Better service quality (SQ), brand image (BI), and a higher frequency of shuttle bus service (SB) will decrease the performance risk and increase the market demand (D). Therefore, based on the factors of SQ, BI, and SB, we revise the performance risk as follows:

$$\text{Performance risk} = r_2 \times [1 - (\text{SQ} \times \text{BI} \times \text{SB}) \times \text{D}], \quad (4)$$

$$0 \leq \text{SQ} \leq 1; 0 \leq \text{LP} \leq 1; 0 \leq \text{SB} \leq 1.$$

Third, financial risk is a potential loss of money resulting from a purchase, which can be referred to as obtaining the same value of service as other forms of accommodation such as hotels or homestays, but which one pays a higher expenditure; another example is obtaining a refund rate (RR) from the accommodation in the event of not being able to stay, which is lower with a higher charged administration fee. Therefore, based on the factors of RR, we revise the financial risk as follows:

$$\text{Financial risk} = r_3 (1 - \text{RR}), 0 \leq \text{RR} \leq 1 \quad (5)$$

Finally, when booking a budget hotel, the user is required to fill out their personal information, including payment information (credit card number), for creating an account on the online platform, which is the most important aspect of the privacy risk. Reducing privacy risks during online transactions is the most important factor for the service providers, and thus, for the system investment (SI) a robust online platform is important. Based on the factor of SI, we revise the financial risk as follows:

$$\text{Privacy risk} = r_4 (1 - \text{SI}), 0 \leq \text{SI} \leq 1 \quad (6)$$

These four types of risks might also exist in the traditional luxury hotels, but they can be thought of as major risks in the branched budget hotels newly held by the luxury hotels. Therefore, based on the above revisions on risks, we can revise Equation (1) as follows:

$$\theta - r_1 \times \text{RPN} - r_2 \times [1 - (\text{SQ} \times \text{BI} \times \text{SB}) \times \text{D}] - r_3 (1 - \text{RR}) - r_4 (1 - \text{SI}) - p \geq \theta_0 - p_0 \quad (7)$$

### 3. Optimization Analysis for the Demand of Budget Hotels

With the assumption that both  $\theta$  and  $\theta_0$  are independently and uniformly distributed on  $[0, 1]$ , applying the self-selection utility constraint, the endogenous demand for the budget hotel is derived as follows:

$$\begin{aligned}
 D &= P(\theta > \theta_0 + r_1 \times RPN + r_2 \times [1 - (SQ \times BI \times SB) \times D] + r_3(1 - RR) + r_4(1 - SI) + p - p_0), \\
 &= \int_0^1 (\int_{\theta_0 + r_1 \times RPN + r_2 \times [1 - (SQ \times BI \times SB) \times D] + r_3(1 - RR) + r_4(1 - SI) + p - p_0}^1 1 d\theta) d\theta_0 \\
 &= \int_0^1 1 - \{\theta_0 + r_1 \times RPN + r_2 \times [1 - (SQ \times BI \times SB) \times D] + r_3(1 - RR) + r_4(1 - SI) + p - p_0\} d\theta_0 \\
 &= \frac{1}{2} - p - r_1 \times RPN - r_2 [1 - (SQ \times BI \times SB) \times D] - r_3(1 - RR) - r_4(1 - SI) + p_0
 \end{aligned} \tag{8}$$

From the self-selection utility constraint, the endogenous demand for the budget hotel is given by:

$$D = \frac{1 - 2(p + r_1 \times RPN + r_2 + r_3(1 - RR) + r_4(1 - SI) - p_0)}{2 - 2r_2 (SQ \times BI \times SB)}. \tag{9}$$

Then, we have the following profit maximization problem:

$$\max \pi = Dp = \left( \frac{1 - 2(p + r_1 \times RPN + r_2 + r_3(1 - RR) + r_4(1 - SI) - p_0)}{2 - 2r_2 (SQ \times BI \times SB)} \right) p \tag{10}$$

We now analyze the first derivative of Equation (10) with respect to the posted price  $p$  shown in the platform of the budget hotel. From the first derivative condition for Equation (10), the optimal posted price  $p^*$  can be solved as shown in Equation (11). Next, by inputting the optimal posted price  $p^*$  to Equations (9) and (10), the optimal demand and profit of the budget hotel can be obtained through Equations (12) and (13).

$$p^* = \frac{1 + 2p_0 - 2(r_1 \times RPN + r_2 + r_3(1 - RR) + r_4(1 - SI))}{4} \tag{11}$$

$$D^* = \frac{1 + 2p_0 - 2(r_1 \times RPN + r_2 + r_3(1 - RR) + r_4(1 - SI))}{4[1 - r_2 (SQ \times BI \times SB)]} \tag{12}$$

$$\pi^* = \frac{[1 + 2p_0 - 2(r_1 \times RPN + r_2 + r_3(1 - RR) + r_4(1 - SI))]^2}{16[1 - r_2 (SQ \times BI \times SB)]} \tag{13}$$

The optimal price  $p^*$  appears to be independent of SQ, BI, and SB, but dependent on RPN, RR, and SI. That is, service quality, brand image, or higher frequency of shuttle buses do not affect the optimal price shown in the platform of budget hotels. Therefore, it is needed for the platform of budget hotels to stick to an affordable pricing policy, regardless of the degree of satisfaction that the customers have with the original luxury hotel, which proves one of the main advantages recognized by the consumers participating in the branched budget hotel. However, when there is an investment in performance risk improvement by the RPN, an administrative policy revision for the rate of refunds, or an investment in the platform system, the branched budget hotel can set a higher price than the other budget hotels because the investment makes the utility of the budget hotel platform closer to the utility of the luxury hotel as the platform has some responsibility for customer safety. The higher price also indicates that it is worthwhile for the platform provider to invest in safety so as to reduce the physical risk as, on the contrary, the optimal demand  $D^*$  and optimal profit  $\pi^*$  are dependent on SQ, BI, and SB. That is, a higher service quality, the brand image, and a higher-frequency shuttle bus will positively affect the budget hotel's optimal demand and profit. The major segmentation criterion for a budget hotel is its lower price for each stay; thus, the staff may not have sufficient training, and sometimes the hotel does not have the support for a higher-frequency shuttle bus. Therefore, it is important to trade-off the optimal market demand and profit of the performance risk with respect to the factors of SQ, BI, and SB.

#### 4. Sensitivity Analysis for Subsidies with Regard to the Demand of Budget Hotels

During the COVID-19 pandemic period, having a positive policy to assist with the hotel industry's survival under huge losses is important for strategy formulations. Therefore, this analytical model is still extended to explore three possible scenarios of government

subsidy. In addition to the discussion for the risk mentioned above, in order to reduce the huge loss during the period of COVID-19 for each type of hotel, the government subsidy can be used to support the budget hotels to increase the market demand. The subsidy can be discussed with regard to the following aspects:

- (1) The subsidy supports staff training.

Let  $s$  be the fixed value for the strength of the government subsidy to support the improvement in service quality. The performance risk then decreases to  $r_2 \times [1 - (SQ(1 + s) \times BI \times SB) \times D]$  through the support of staff training, and the revised performance risk is independent of the RPN, RR, and SI. Then, the consumer self-selection utility is defined as follows:

$$\theta - r_1 \times RPN - r_2 \times [1 - (SQ(1 + s) \times BI \times SB) \times D] - r_3(1 - RR) - r_4(1 - SI) - p \geq \theta_0 - p_0 \tag{14}$$

With the assumption that both  $\theta$  and  $\theta_0$  are independently and uniformly distributed on  $[0, 1]$ , the endogenous demand for the budget hotel is derived as follows:

$$\begin{aligned} D &= P(\theta > \theta_0 + r_1 \times RPN + r_2 \times [1 - (SQ(1 + s) \times BI \times SB) \times D] + r_3(1 - RR) + r_4(1 - SI) + p - p_0), \\ &= \int_0^1 (\int_{\theta_0 + r_1 \times RPN + r_2 \times [1 - (SQ(1 + s) \times BI \times SB) \times D] + r_3(1 - RR) + r_4(1 - SI) + p - p_0}^1 1 d\theta) d\theta_0 \\ &= \int_0^1 1 - \{\theta_0 + r_1 \times RPN + r_2 \times [1 - (SQ(1 + s) \times BI \times SB) \times D] + r_3(1 - RR) + r_4(1 - SI) + p - p_0\} d\theta_0 \\ &= \frac{1}{2} - p - r_1 \times RPN - r_2[1 - (SQ(1 + s) \times BI \times SB) \times D] - r_3(1 - RR) - r_4(1 - SI) + p_0 \end{aligned}$$

Therefore, the endogenous demand for the platform is given by:

$$D = \frac{1 - 2(p + r_1 \times RPN + r_2 + r_3(1 - RR) + r_4(1 - SI) - p_0)}{2 - 2r_2(SQ(1 + s) \times BI \times SB)} \tag{15}$$

Then, we have the following profit maximization problem:

$$\max \pi = Dp = \left( \frac{1 - 2(p + r_1 \times RPN + r_2 + r_3(1 - RR) + r_4(1 - SI) - p_0)}{2 - 2r_2(SQ(1 + s) \times BI \times SB)} \right) p \tag{16}$$

We now analyze the first derivative of Equation (16) with respect to the posted price  $p$  shown on the platform of the budget hotel. From the first derivative condition for Equation (16), the optimal posted price  $p^*$  can be solved as shown in Equation (17). Next, by inputting the optimal posted price  $p^*$  to Equations (15) and (16), the optimal demand and profit of the budget hotel can be obtained through Equations (18) and (19).

$$p^* = \frac{1 + 2p_0 - 2(r_1 \times RPN + r_2 + r_3(1 - RR) + r_4(1 - SI))}{4} \tag{17}$$

$$D^* = \frac{1 + 2p_0 - 2(r_1 \times RPN + r_2 + r_3(1 - RR) + r_4(1 - SI))}{4[1 - r_2(SQ(1 + s) \times BI \times SB)]} \tag{18}$$

$$\pi^* = \frac{[1 + 2p_0 - 2(r_1 \times RPN + r_2 + r_3(1 - RR) + r_4(1 - SI))]^2}{16[1 - r_2(SQ(1 + s) \times BI \times SB)]} \tag{19}$$

The optimal price  $p^*$  appears to be independent of  $SQ$ ,  $BI$ , and  $SB$ , but dependent on  $RPN$ ,  $RR$ , and  $SI$ , and the government subsidy for the staff training does not affect the optimal price  $p^*$ . On the contrary, the government subsidy for the staff training affects the optimal demand  $D^*$  and optimal profit  $\pi^*$ . That is, the government subsidy affects the service quality, which changed to be  $SQ(1 + s)$ , will increase the budget hotels' demand and profit. The major segmentation criterion for budget hotels is the lower price for each stay; thus, the staff training subsidy can improve the service quality so as to attract more travelers to stay at the budget hotel and increase their profit.

We now analyze the first derivative of the optimal posted price  $p^*$ , optimal demand  $D^*$ , and profit  $\pi^*$  of budget hotels with respect to the government subsidy for the staff training as follows:

$$\frac{dp^*}{ds} = 0 \tag{20}$$

$$\frac{dD^*}{ds} = \frac{r_2(SQ \times BI \times SB)[1 + 2p_0 - 2(r_1 \times RPN + r_2 + r_3(1 - RR) + r_4(1 - SI))]}{4[1 - r_2(SQ(1 + s) \times BI \times SB)]^2} \tag{21}$$

$$\frac{d\pi^*}{ds} = \frac{r_2(SQ \times BI \times SB)[1 + 2p_0 - 2(r_1 \times RPN + r_2 + r_3(1 - RR) + r_4(1 - SI))]}{16[1 - r_2(SQ(1 + s) \times BI \times SB)]^2} \tag{22}$$

From the derivative results (20)–(22), with respect to the government subsidy for the staff training, we can find that the optimal posted price  $p^*$  will not be affected by the government subsidy for the staff training. However, the optimal demand  $D^*$  and profit  $\pi^*$  of budget hotels are affected by the government subsidy. If  $1 + 2p_0 \geq 2(r_1 \times RPN + r_2 + r_3(1 - RR) + r_4(1 - SI))$ , then the increase in the government subsidy implies the increase in the optimal demand  $D^*$  and profit  $\pi^*$  of the budget hotels. Since the posted price  $p_0$  of the luxury hotels is generally higher, we positively confirm that the increase in the government subsidy implies the increase in the optimal demand  $D^*$  and profit  $\pi^*$  of budget hotels. By contrast, we also can try to improve the RPN, provide a more reliable RR and invest higher in SI, and thus, we can obtain a lower value of  $(r_1 \times RPN + r_2 + r_3(1 - RR) + r_4(1 - SI))$ .

(2) The subsidy supports family travel.

Let  $s$  be the fixed value for the strength of the government subsidy to support each traveler, with a total of  $m$  members ( $m \geq 2$ ). The posted price on the platform of the budget hotels with the subsidy support is revised as  $p(1 - ms)$ , and then, the consumer self-selection utility is defined as:

$$\theta - r_1 \times RPN - r_2 \times [1 - (SQ \times BI \times SB) \times D] - r_3(1 - RR) - r_4(1 - SI) - p(1 - ms) \geq \theta_0 - p_0 \tag{23}$$

The endogenous demand for the platform is given by:

$$\begin{aligned} D &= P(\theta > \theta_0 + r_1 \times RPN + r_2 \times [1 - (SQ \times BI \times SB) \times D] + r_3(1 - RR) + r_4(1 - SI) + p(1 - ms) - p_0), \\ &= \int_0^1 \left( \int_{\theta_0 + r_1 \times RPN + r_2 \times [1 - (SQ \times BI \times SB) \times D] + r_3(1 - RR) + r_4(1 - SI) + p(1 - ms) - p_0}^1 1 d\theta \right) d\theta_0 \\ &= \int_0^1 1 - \{ \theta_0 + r_1 \times RPN + r_2 \times [1 - (SQ \times BI \times SB) \times D] + r_3(1 - RR) + r_4(1 - SI) + p(1 - ms) - p_0 \} d\theta_0 \\ &= \frac{1}{2} - p(1 - ms) - r_1 \times RPN - r_2[1 - (SQ \times BI \times SB) \times D] - r_3(1 - RR) - r_4(1 - SI) + p_0 \end{aligned}$$

The endogenous demand for the platform is given by:

$$D = \frac{1 - 2(p(1 - ms) + r_1 \times RPN + r_2 + r_3(1 - RR) + r_4(1 - SI) - p_0)}{2 - 2r_2(SQ \times BI \times SB)} \tag{24}$$

with the assumption that both  $\theta$  and  $\theta_0$  are independently and uniformly distributed on  $[0, 1]$ . Then, we have the following profit maximization problem:

$$\max \pi = Dp = \left( \frac{1 - 2(p(1 - ms) + r_1 \times RPN + r_2 + r_3(1 - RR) + r_4(1 - SI) - p_0)}{2 - 2r_2(SQ \times BI \times SB)} \right) p \tag{25}$$

We now analyze the optimal choice on price, and examine the effect of each risk on demand and profit. Through the first-order condition, we obtain the optimal price, demand, and profit as follows:

$$p^* = \frac{1 + 2p_0 - 2(r_1 \times RPN + r_2 + r_3(1 - RR) + r_4(1 - SI))}{4(1 - ms)} \tag{26}$$

$$D^* = \frac{1 + 2p_0 - 2(r_1 \times RPN + r_2 + r_3(1 - RR) + r_4(1 - SI))}{4[1 - r_2(SQ \times BI \times SB)]} \tag{27}$$

$$\pi^* = \frac{[1 + 2p_0 - 2(r_1 \times RPN + r_2 + r_3(1 - RR) + r_4(1 - SI))]^2}{16[1 - r_2 (SQ \times BI \times SB)]} \tag{28}$$

The optimal price  $p^*$  appears to be independent of  $SQ$ ,  $BI$ , and  $SB$ , but dependent on  $RPN$ ,  $RR$ , and  $SI$ , and the government subsidy affects the optimal price  $p^*$ . The larger the support of the subsidy for family travel, the higher the optimal price  $p^*$ . As a point of fact, the government subsidy does not affect the optimal demand  $D^*$  and optimal profit  $\pi^*$ . That is, the government subsidy directly supports the family travelers, and thus, the budget hotels' pricing is higher than before. The major policy for budget hotels is a lower price for each stay; when pricing higher than before, budget hotels cannot attract more travelers to stay, and therefore, they also cannot increase their profits.

We now analyze the first derivative of the optimal posted price  $p^*$ , optimal demand  $D^*$ , and profit  $\pi^*$  of the budget hotels with respect to the government subsidy for family travel  $ms$  as follows:

$$\frac{dp^*}{ds} = \frac{m[1 + 2p_0 - 2(r_1 \times RPN + r_2 + r_3(1 - RR) + r_4(1 - SI))]}{4(1 - ms)^2} \tag{29}$$

$$\frac{dD^*}{ds} = 0 \tag{30}$$

$$\frac{d\pi^*}{ds} = 0 \tag{31}$$

From the derivative results (29)–(31), with respect to the government subsidy for the family travel  $ms$ , we can find that the optimal posted price  $p^*$  will be affected by the government subsidy. If  $1 + 2p_0 \geq 2(r_1 \times RPN + r_2 + r_3(1 - RR) + r_4(1 - SI))$ , then the increase in the government subsidy implies the increase in the optimal posted price  $p^*$  of budget hotels. Since the posted price  $p_0$  of a luxury hotel is generally higher, we positively confirm that the increase in the government subsidy implies the increase in the posted price  $p^*$  of budget hotels. However, the optimal demand  $D^*$  and profit  $\pi^*$  of the budget hotels will not be affected by the government subsidy.

(3) The subsidy supports the higher frequency of shuttle buses.

Let  $s$  be the fixed value for the strength of the government subsidy to support the subsidy for the frequency of the shuttle buses, causing higher customer satisfaction, and thus, the performance risk will be lower than before. The performance risk with the subsidy support is revised as  $r_2 \times (1 - s)[1 - (SQ \times BI \times SB) \times D]$ , and then, the consumer self-selection utility is defined as:

$$\theta - r_1 \times RPN - r_2 \times (1 - s) [1 - (SQ \times BI \times SB) \times D] - r_3 (1 - RR) - r_4 (1 - SI) - p \geq \theta_0 - p_0 \tag{32}$$

Then, the endogenous demand for the platform is given by:

$$\begin{aligned} D &= P(\theta > \theta_0 + r_1 \times RPN + r_2 \times (1 - s)[1 - (SQ \times BI \times SB) \times D] + r_3(1 - RR) + r_4(1 - SI) + p - p_0), \\ &= \int_0^1 (\int_{\theta_0 + r_1 \times RPN + r_2 \times (1 - s) [1 - (SQ \times BI \times SB) \times D] + r_3(1 - RR) + r_4(1 - SI) + p - p_0}^1 1 d\theta) d\theta_0 \\ &= \int_0^1 1 - \{\theta_0 + r_1 \times RPN + r_2(1 - s) \times [1 - (SQ \times BI \times SB) \times D] + r_3(1 - RR) + r_4(1 - SI) + p - p_0\} d\theta_0 \\ &= \frac{1}{2} - p - r_1 \times RPN - r_2(1 - s)[1 - (SQ \times BI \times SB) \times D] - r_3(1 - RR) - r_4(1 - SI) + p_0 \end{aligned}$$

Therefore, the endogenous demand for the platform is obtained as:

$$D = \frac{1 - 2(p + r_1 \times RPN + r_2(1 - s) + r_3(1 - RR) + r_4(1 - SI) - p_0)}{2 - 2r_2(1 - s)(SQ \times BI \times SB)} \tag{33}$$

We assume that both  $\theta$  and  $\theta_0$  are independently and uniformly distributed on  $[0, 1]$ . Then, we have the following profit maximization problem:

$$\max \pi = Dp = \left( \frac{1 - 2(p + r_1 \times RPN + r_2(1 - s) + r_3(1 - RR) + r_4(1 - SI) - p_0)}{2 - 2r_2(1 - s)(SQ \times BI \times SB)} \right) p \tag{34}$$



We analyze the optimal choice of price, and examine the effect of each risk on demand and profit. Through the first-order condition, we obtain the optimal price, demand, and profit as follows:

$$p^* = \frac{1 + 2p_0 - 2(r_1 \times RPN + r_2(1 - s) + r_3(1 - RR) + r_4(1 - SI))}{4} \tag{35}$$

$$D^* = \frac{1 + 2p_0 - 2(r_1 \times RPN + r_2(1 - s) + r_3(1 - RR) + r_4(1 - SI))}{4[1 - r_2(1 - s)(SQ \times BI \times SB)]} \tag{36}$$

$$\pi^* = \frac{[1 + 2p_0 - 2(r_1 \times RPN + r_2(1 - s) + r_3(1 - RR) + r_4(1 - SI))]^2}{16[1 - r_2(1 - s)(SQ \times BI \times SB)]} \tag{37}$$

The optimal price  $p^*$  appears to be independent of  $SQ$ ,  $BI$ , and  $SB$ , but dependent on  $RPN$ ,  $RR$ , and  $SI$ , and the government subsidy affects the optimal price  $p^*$ , causing it to be higher than before the subsidy when increasing the frequency of the shuttle buses. The larger the support of the subsidy for the frequency of the shuttle buses, the higher the optimal price  $p^*$ . In addition, the government subsidy also affects the optimal demand  $D^*$  and optimal profit  $\pi^*$ . That is, the higher the government subsidy is to directly support the shuttle buses, the more it will attract more customers to stay at the budget hotels, and thus, it will increase the optimal demand and profit.

We now analyze the first derivative of the optimal posted price  $p^*$  and optimal demand  $D^*$  of the budget hotels with respect to the government subsidy for the higher frequency of shuttle buses as follows:

$$\frac{dp^*}{ds} = \frac{r_2}{2} > 0 \tag{38}$$

$$\frac{dD^*}{ds} = \frac{2r_2[1 - r_2(1 - s)(SQ \times BI \times SB) - 4r_2(SQ \times BI \times SB)[1 + 2p_0 - 2(r_1 \times RPN + r_2(1 - s) + r_3(1 - RR) + r_4(1 - SI))]}{4[1 - r_2(1 - s)(SQ \times BI \times SB)]^2} \tag{39}$$

From the results of Equation (38), we can find that the optimal posted price  $p^*$  will be higher with the higher frequency of the shuttle buses. Next, by simplifying Equation (39), we find the smallest value of the government subsidy  $s$  for the higher frequency of the shuttle buses as follows:

$$s > \frac{2 - (SQ \times BI \times SB)[1 + 2p_0 - 2(r_1 \times RPN + r_3(1 - RR) + r_4(1 - SI))]}{4r_2(SQ \times BI \times SB)} \tag{40}$$

If government subsidy  $s$  is higher than the lower boundary of Equation (40), then the increase in government subsidy implies the increase in the optimal posted price  $D^*$  of budget hotels. Therefore, the profit  $\pi^*$  of budget hotels will also be maximized by the government subsidy supporting a higher frequency of shuttle buses.

### 5. Conclusions

The scientific novelty of the research focuses on luxury hotels that would like to transform some of their branches to budget hotels. As the budget hotels are promoted, concerns about the risks, and hence, the issue of risk management becomes of vital importance, and we included the physical risk, performance risk, financial risk, and privacy risk in the consumer self-selection utility model. In addition, we also examined the effectiveness of the market demand, which included the factors of Risk Priority Number (RPN), service quality, brand image, shuttle bus service, refund rate (RR), and system investment (SI), so as to stimulate the online platform. Most importantly, if the proposed self-selection utility model meets expectations, the optimal price, demand, and profit of budget hotels can be obtained. The conclusion section can be extended as follows:

- (1) The strategic analysis in this paper. In our proposed model, we investigate each risk type that affects the budget hotels with regard to the optimal price, demand, and

profit. In addition, the government subsidy will also affect the budget hotels with regard to the optimal price, demand, or profit based on the requirement of  $1 + 2p_0 \geq 2(r_1 \times RPN + r_2 + r_3(1 - RR) + r_4(1 - SI))$ . While focusing on the RPN, refund rate (RR), and system investment (SI), we also need to consider the performance risk with regard to service quality, brand image, and the higher frequency of shuttle bus services, as shown in Equation (40). Therefore, the lower boundary of the government subsidy for the higher frequency of the shuttle buses will also affect the optimal demand and profit of budget hotels. Finally, we also investigated the effect of the government subsidy on the market demand, price, and profit of the budget hotels in the section of sensitivity analysis. Therefore, the budget hotels can try to lobby for a policy on the government subsidies to improve and maximize their market demand and profit.

- (2) Limitations of this research. Because a different decision maker has a different utility function, the self-selection utility model might be applied with a different risk management attitude by a different decision maker. Therefore, a group of experts invited to offer efficient risk factors are very important. Finally, we suggest including some new factors to make the sensitivity analysis for the proposed model.
- (3) Future research. The efforts to manage different types of risks may play a central role in moving from the budget hotels' platform to a huge market place that generates tremendous economic benefits beyond one of the current trends. This is because there are still numerous areas in which the sharing economy can be applied with a larger number of participating customers, some of whom have previously been reluctant to participate in the sharing economy.

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## References

1. Hua, W.; Chan, A.; Mao, Z. Critical success factors and customer expectation in budget hotel segment—A case study of China. *J. Qual. Assur. Hosp. Tour.* **2009**, *10*, 59–74. [\[CrossRef\]](#)
2. Ahmad, A.; Idris, N.A.; Ibrahim, Y.A. Critical Success Factors and Customer Satisfaction in Budget Hotels: A Case Study from Malaysia. *J. Tour. Hosp.* **2018**, *7*, 1000346. [\[CrossRef\]](#)
3. Albattat, A.R.; Amer, H. Backpackers Expectation and Satisfaction towards Budget Hotel: A Case Study in Penang. *Almatour.-J. Tour. Cult. Territ. Dev.* **2016**, *7*, 168–180.
4. Ahmad, R.; Scott, N.; Abdul-Rahman, R. Why minimum wage order implementation is a challenge to human resource managers in Langkawi hotels. *Int. J. Cult. Tour. Hosp. Res.* **2016**, *10*, 191–204. [\[CrossRef\]](#)
5. Guillet, B.D.; Mattila, A.S. A descriptive examination of corporate governance in the hospitality industry. *Int. J. Hosp. Manag.* **2010**, *29*, 677–684. [\[CrossRef\]](#)
6. Ooi, C.-A.; Hooy, C.-W.; Som, A.P.M. Diversity in human and social capital: Empirical evidence from Asian tourism firms in corporate board composition. *Tour. Manag.* **2015**, *48*, 139–153. [\[CrossRef\]](#)
7. Sigala, M. Collaborative commerce in tourism: Implications for research and industry. *Curr. Issues Tour.* **2017**, *20*, 346–355. [\[CrossRef\]](#)
8. Tsai, W.-H.; Hsu, W.; Chou, W.-C. A gap analysis model for improving airport service quality. *Total Qual. Manag. Bus. Excell.* **2011**, *22*, 1025–1040. [\[CrossRef\]](#)
9. Quintal, V.A.; Lee, J.A.; Soutar, G.N. Risk, uncertainty and the theory of planned behavior: A tourism example. *Tour. Manag.* **2010**, *31*, 797–805. [\[CrossRef\]](#)

10. Dholakia, U.M. A motivational process model of product involvement and consumer risk perception. *Eur. J. Mark.* **2001**, *35*, 1340–1362. [[CrossRef](#)]
11. Gursoy, D.; Chi, C.G. Effects of COVID-19 pandemic on hospitality industry: Review of the current situations and a research agenda. *J. Hosp. Mark. Manag.* **2020**, *29*, 527–529. [[CrossRef](#)]
12. Ert, E.; Fleischer, A.; Magen, N. Trust and reputation in the sharing economy: The role of personal photos in Airbnb. *Tour. Manag.* **2016**, *55*, 62–73. [[CrossRef](#)]
13. Yi, J.; Yuan, G.; Yoo, C. The effect of the perceived risk on the adoption of the sharing economy in the tourism industry: The case of Airbnb. *Inf. Process. Manag.* **2020**, *57*, 102108. [[CrossRef](#)]
14. Laroche, M.; McDougall, G.H.G.; Bergeron, J.; Yang, Z. Exploring How Intangibility Affects Perceived Risk. *J. Serv. Res.* **2004**, *6*, 373–389. [[CrossRef](#)]
15. Belk, R. You are what you can access: Sharing and collaborative consumption online. *J. Bus. Res.* **2014**, *67*, 1595–1600. [[CrossRef](#)]
16. Malhotra, N.K.; Kim, S.S.; Agarwal, J. Internet users' information privacy concerns (IUIPC): The construct, the scale, and a causal model. *Inf. Syst. Res.* **2004**, *15*, 336–355. [[CrossRef](#)]
17. Lutz, C.; Hoffmann, C.P.; Bucher, E.; Fieseler, C. The role of privacy concerns in the sharing economy. *Inf. Commun. Soc.* **2018**, *21*, 1472–1492. [[CrossRef](#)]
18. Guttentag, D.; Smith, S.; Potwarka, L.; Havitz, M. Why tourists choose Airbnb: A motivation-based segmentation study. *J. Travel Res.* **2018**, *57*, 342–359. [[CrossRef](#)]
19. Guttentag, D. Airbnb: Disruptive innovation and the rise of an informal tourism accommodation sector. *Curr. Issues Tour.* **2015**, *18*, 1192–1217. [[CrossRef](#)]
20. Zervas, G.; Proserpio, D.; Byers, J.W. The rise of the sharing economy: Estimating the impact of Airbnb on the hotel industry. *J. Mark. Res.* **2017**, *54*, 687–705. [[CrossRef](#)]
21. Mussa, M.; Rosen, S. Monopoly and product quality. *J. Econ. Theory* **1978**, *18*, 301–317. [[CrossRef](#)]
22. Hong, J.H.; Kim, B.C.; Park, K.S. Optimal risk management for the sharing economy with stranger danger and service quality. *Eur. J. Oper. Res.* **2019**, *279*, 1024–1035. [[CrossRef](#)]
23. Moorthy, K.S.; Png, I.P. Market segmentation, cannibalization, and the timing of product introductions. *Manag. Sci.* **1992**, *38*, 345–359. [[CrossRef](#)]
24. Chatterjee, K.; Samuelson, W. Bargaining under incomplete information. *Oper. Res.* **1983**, *31*, 835–851. [[CrossRef](#)]
25. Rochet, J.C.; Tirole, J. Two-sided markets: A progress report. *RAND J. Econ.* **2006**, *37*, 645–667. [[CrossRef](#)]
26. Sarkis, J.; Talluri, S. A model for strategic supplier selection. *J. Supply Chain. Manag.* **2002**, *38*, 18–28. [[CrossRef](#)]
27. Ryu, K.; Lehto, X.Y.; Gordon, S.E.; Fu, X. Effect of a brand story structure on narrative transportation and perceived brand image of luxury hotels. *Tour. Manag.* **2019**, *71*, 348–363. [[CrossRef](#)]