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The Impact of Discount Policy on Hotel Pricing in a Competitive Market after Covid-19 Using Game Theory

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Abstract

This paper presents an optimization model for hotel pricing in the competitive environment following the Covid-19 epidemic, in which the government intervenes by offering appropriate tariffs and hotels use incentive policies such as discounts to attract customers. we consider the government as the leader and the hotels as the followers of the Stalkberg model, then apply the Nash equilibrium to determine the optimal price and demand of hotels in competitive conditions, taking into account the discount. By considering a government utility function, the optimal level of government tariffs is determined. The results indicate that government intervention in the tourism industry includes measures that benefit tourism. Because the government can increase the hotel revenue and expand tourism in favor of hoteliers by reducing its profits. Extensive analysis has been performed on five-star, four-star, and three-star hotels in a tourist area in Iran, and some of the most important managerial insights have been explained.

Keywords: Hotel pricing, Discount, Game theory, Tourism industry, Stakelberg game.

1 | Introduction

The tourism industry, one of the broadest development prospects of the 21st century, has the potential for sustainable development and risk resistance [1]. In the last two decades, tourism has experienced a continuous and profound expansion and has become one of the fastest economic sectors in the world, becoming the fourth largest export industry after the oil, petrochemical, and food industries [2], [3]. For this reason, the tourism industry is considered as a vital tool for the development and improvement of economic conditions in many parts of the world [4]. Despite all the capabilities of the tourism industry, it is highly vulnerable to external disasters such as natural disasters such as floods, earthquakes, hurricanes, terrorism, and fires, and the spread of epidemics such as SARS and, more recently, the Corona pandemic. Therefore, any disasters such as the spread of an epidemic or the start of a war, or other natural disasters will lead to a recession in the industry and cause serious damage to it [4], [5]. After several people contracted unusual pneumonia in December 2019, China

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introduced a new strain of the coronavirus as the cause of a new respiratory illness. With the rapid spread of the disease in China and then to other parts of the world, the new coronavirus, scientifically known as acute coronavirus syndrome (SARS-Cov-2), and the resulting disease, known as Quaid-19 disease, has caused great concern and panic among the people of the world [6]. Covid-19 has caused serious and irreparable damage to the tourism industry and posed serious challenges to all related sectors. According to figures released by the World Bank, the Covid-19 epidemic has plunged the world economy into its worst recession since World War II, with a 4.3% drop in global GDP by 2020 [7]. Among all the Covid-19-influenced industries, tourism was among the most affected, with an epidemic that reduced international tourism inflows by 74% in 2020 compared to 2019. In addition to concerns about the spread of the Corona pandemic, the growing increase in human activity has produced large amounts of Greenhouses Gas (GHG), leading to severe global warming and climate change. Many researchers believe that the current global warming scenario, particularly GHG emissions are driven by human activities, by energy-intensive sectors such as hotels [8]. To maintain sustainable development, governments generally implement various measures and policies to reduce emissions [9]. Because green tourism can be described as a concept similar to sustainable development. Thus, green tourism embraces the concept of sustainable development and is based on the idea of harmony between people and the environment. Therefore, green tourism means that tourism activists, including hoteliers, tourists, restaurants, travel agencies, and tour guides, must respect nature and protect the environment in all aspects of the entire tourism process [1]. To this end, hotels as one of the most important factors in the development of tourism in countries adopt new approaches to make optimal decisions for the growth and development of the tourism industry [10]. To achieve this goal, hoteliers rely on adopting an essential strategy to compete and gain a competitive advantage [11]. In fact, this particular approach can lead hoteliers to more stable incomes than competitors [12]. Based on the above, the widespread prevalence of pandemics such as Covid-19, wars, and natural and unnatural disasters can have a detrimental effect on tourist attractions. In this study, we intend to investigate the effect of discounts on prices as a balanced competitive strategy for the post-pandemic period in the tourism industry. Because, we believe that the adoption of discount policies can deal with the damage caused by reducing the attractiveness of the tourism industry in unusual conditions, and in addition, hoteliers also enjoy the economic benefits of expanding the tourism industry in a challenging competitive environment with which the world today Is involved in maintaining their income. The purpose of this study is to provide a suitable model for discount-based pricing for hotels that compete with the same stars (three stars, four stars, five stars) but different services. The purpose of this study is to provide a suitable model for discount-based pricing for hotels that compete with the same stars (three stars, four stars, five stars) but different services. The most important contribution of this article is to consider the incentive policy of the government as a leader and the discount policy of hotels as a follower.

- *What effect do incentive policies to attract tourists, such as discounts or the use of free facilities in tourism complexes, have on customer demand in post-coronary conditions?*
- *What is the role of the government as a leader in the post-corona situation to support hoteliers?*
- *What is the impact of prices on tourist demand?*

The rest of this article is organized as it turns out. In Section 2, a literature review of the main research topic is presented. In Section 3, the proposed method for research is introduced. In this section, while introducing the problem in detail, the relevant modeling is stated. In Section 4, the results of using the proposed model are shown. Finally, the Section 5 provides an overview with suggestions for future research.

2 | Literature Review

Covid-19 is an unknown disease that the world has been affected, therefore as a result of this crisis the hotel industry is facing severe challenges [13]. This major challenge has affected all stakeholders in the hotel industry due to travel bans and social distance laws, and as a result, tourists' willingness and access to travel have decreased [14]. This has led tourists to cancel travel and hotel reservation plans, which

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has ultimately affected job security and the income of hotel staff [15]. In this situation, many hotel owners have temporarily closed or transferred their property, in which case this scenario has led to a sharp decline in the stock market value in the hotel sector. In other words, the epidemic has devastated the market and the performance of hotel companies [13]. In this regard, Chopra et al. [16] implemented different pricing strategies for companies in the face of the Quidd-19 pandemic crisis. To this end, the pricing strategies of several high-risk industries were discussed. This study helps companies understand the economic situation and develop pricing strategies based on it. Such pricing strategies allow companies to satisfy their customers in order to stay competitive and achieve business superiority. In general, based on studies, we classify the research literature into three categories; 1) revenue management in the hotel industry, 2) pricing in the hotel industry, and 3) discount pricing models in the hotel industry. The first category is revenue management, which is defined as an information and pricing system to achieve sufficient capacity at the right time and in the right place and thus maximize revenue [17], [18]. To this end, Aydin and Birbil [19], using the dynamic analysis method, provided a framework for managing hotel revenue in room allocation. Paving the way for future hotel revenue management studies on late payment and overbooking is one of the upstream goals in this study. To this end, several room allocation policies in hotel revenue management have been examined. Baker et al. [20] studied hotel revenue management with the aim of organizing the literature on hotel revenue management systems and comparing hotel management systems in terms of performance. In this study, new areas of forecasting include creating a measure of the degree of appropriateness of a hotel pricing strategy and using it to quantify online surveys for forecasts. New ways of optimizing prices, including determining whether a mismatch between a customer's perception of justice and trust and pricing history have a detrimental effect on overall hotel performance, have been introduced as new pricing methods. Klein et al. [21] provide an overview of revenue management and its applications in various industries such as aerospace, hospitality, delivery, and manufacturing since 2004. The second category is determining the optimal price for hotels, which is a complex process. Because, hotels have to consider various factors such as accessibility, customer evaluation of the services provided and future demands [22]. The important point in determining the optimal price is the optimal allocation [23]. Vives and Jacob [24] presented a model for dynamic pricing for hotel demand. The results of this study show that 1) seasonality, number of available rooms, hotel location, and tourist characteristics affect dynamic pricing, 2) reservation constraints lead to further reductions in revenue under elastic demand, 3) higher levels of demand elasticity usually produce lower levels of prices, and 4) distribution of elasticities across the horizon of reserve and natural variability of demand affects dynamic pricing. Mariello et al. [25] provide a simulation optimization-based framework for hotel pricing. In this paper, we introduce hotel simulation as an optimization approach based on flexible simulation. They used parametric demand models to inject new information into the simulator and adapt pricing policies to mutant market conditions. Also, cancellations and reservations are made on an intermediate basis and seasonal averages can be adjusted on a daily basis. Mousavi et al. [26] presented a model for optimizing prices in a competitive environment from the perspective of energy-saving and environmental protection, in which the government intervenes by providing appropriate tariffs for their performance. Extensive analysis was performed on hotels in a tourist area in Iran and some of the most important managerial insights are explained. This study, for the first time, examines the impact of government interference on hotel pricing as hotels compete with different characteristics. Hence, a decentralized decision-making structure is considered for hotels. In addition, this paper presents a new model for providing optimal prices for hotels in a competitive market, optimal hotel revenues, and optimal government tariffs. The third category is discount pricing models in times of crisis and when demand is declining unusually. For example, Kim et al. [27], in their paper, analyze the effect of price reductions on improving hotel performance. Given that crisis management strategies are very important for hotels; little research has been done. As a pioneer in this regard, this study examined the effect of price on improving the performance of hotels and showed that price reduction helps hotel management. Lotfi et al [28] proposed a novel viable a Medical Waste Chain Network Design (MWCND) by a novel two-stage robust stochastic programming that considers resiliency (flexibility and network complexity) and sustainable (energy and environment) requirements. Lotfi et al [29] explored a Robust, Risk-aware, Resilient, and Sustainable Closed-Loop Supply Chain Network Design (SCND) (3RSCLSCND) to tackle demand fluctuation like Covid-19 pandemic. For this purpose, a two-stage robust stochastic multiobjective programming model serves to express the proposed problems in formulae. Lotfi et al. [30] indicated resilience and sustainable SCND by considering Renewable Energy (RE) for the first time. A two-stage new robust stochastic optimization is embedded for RSSCNDRE. The first stage locates facility location and RE and the second stage defines flow quantity between Supply chain components. Based on the above, research that can provide a discount pricing model for the hotel industry based on the knowledge gained is less visible. Therefore, in this study, we intend to provide a suitable model for the price and demand of hotels in a tourist area by considering the discount coefficient to encourage tourists when they desire to stay and attract tourists decreases.

3 | Problem Description and Model Presentation

3.1 | Prerequisites and Assumption

It is assumed that hotels i and j with the same stars, which are green and non-green, are competing with each other in a tourist area in northern Iran. Accordingly, hotel i strives to provide better green services compared to hotel j in terms of hotel management indicators. The hotel index is a criterion that is determined based on the pollution standards of each country. The higher this value means that the hotel is performing well in its public uses. These hotels lost a lot of demand in the face of the Covid-19 pandemic outbreak, but are now competing with each other to attract tourists by reducing their initial inflammation by pursuing their own policies. The policy of green hotel is to rely on the environment friendly aspect, and the policy of non-green hotels is to emphasize discounts on prices. Given the above, in this study, we want to examine the impact of each of the above hypotheses on demand. The symbols used in this research are shown in *Table 1*.

Table 1. Model symbols.

Symbol	Description
p'_i	Hotel prices i taking into account government tariffs
d	Replacement coefficient of two hotels with each other
p'_j	Hotel prices j taking into account government tariffs
β	Sensitivity of a hotel's demand to the level of competitor service
s_i	Hotel index for hotel i
y	Sensitivity of a hotel's demand to the level of competitor service $\beta > y$
s_j	Hotel index for hotel j
c_i	Variable cost for hotel i
c_j	Variable cost for hotel j
η_i	Hotel service investment efficiency coefficient i
η_j	Hotel service investment efficiency coefficient j
c'_i	Fixed fee for hotel i
c'_j	Fixed fee for hotel j
μ	Modulator of tourist attraction for hotel i in competition with hotel j; $0 < \mu < 1$
γ_i	Price adjustment rate for hotel i at a discount
γ_j	Price adjustment rate for hotel j in terms of discount
ϕ	Energy saving coefficient for hotel demand base i in competition with hotel j; $0.5 < \phi < 1$
a	Random base market value for hotels
Ω	Relative weight ratio between tourism industry expansion and hotel demand
λ	The relative weight of government revenue relative to hotel revenue
U	Government utility function

In this study, we consider two distinct hotels with the same star in a tourist area that has many hotels. Although the hotels are the same stars, the hotel service index in them is different and as a result, this affects the price of hotels. Waste management, energy-saving is among the policies included in the hotel index. The study uses the Stackelberg game with decentralized conditions, in which the government, as a leader, oversees the performance of hotels and can impose various tariffs on hotels at its discretion. For example, the equilibrium rate for hotels i and j is set by the government. In the Stalkberg game, the leader is the provider of better goods and services, which is in a higher position than the follower and has more power. However, after observing and considering the market leader's decision, the follower determines his strategy in a game. In this case, if the government decides to boost tourism and encourage hotels to make better use of resources by subsidizing hotels, then prices will be affordable for customers. In contrast, in crowded tourist areas, the government can make money by imposing significant taxes on hotels. Also, when demand falls sharply; for example, when faced with a corona pandemic, the government imposes a percentage discount on hoteliers to consider a discount on their price. The most important goal in this study is to analyze the interactions between hotels at a time when the government is interfering in their performance. In addition, these hotels can have a centralized or decentralized decision-making structure. In this regard, we assume that hotels compete with each other, although each can set its own prices. Of course, the price is set by the hotels using the discount rate set by the government based on the type of hotel. *Fig. 1* schematically shows the competitive orientation of hotels in a decentralized decision-making structure.

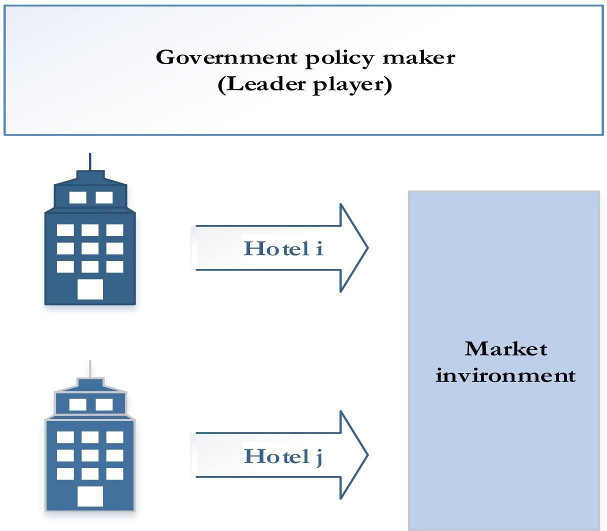

Fig. 1. Government intervention in competition with hotels.

3.2 | Research Modeling

The development of the model presented in this paper is in line with the development of the model of Mousavi et al. [26], by adding the idea of discount as follows. In the proposed model, it is assumed that the discount in hotel i or j is offered when demand decreases, in which case the hotel will offer a discount of γat its price $P'_{I,j}$. In the proposed relations, γis considered as a parameter whose value is determined by the government. Therefore, if the price after the value added is equal to $P'_{i,j} = \left(P_{i,j} + t\right)$ after applying the discount percentage as $P'_{i,j} = \gamma_{i,j}\left(P_{i,j} + t\right)$ will be converted. In fact, γ plays the role of a discount rate for the price of hotel accommodation. For this purpose, for the amount of demand of each hotel i or j, we consider two amounts of demand as a set of *Eqs. (1)* and *(2)*. So that in one relation the mode with discount is considered and in the other relation the mode without discount is considered. It should be noted that both relationships are not established and in each case only one relationship is established. For this purpose, we consider a binary variable that plays such a role.

$$\tilde{q}_I = \{\mu a - \gamma_I P'_I + d\gamma_I P'_j + \beta s_I - y s_j + MK_1. \quad (1\text{-a})$$

$$\tilde{q}_I = \{\mu a - P'_I + dP'_j + \beta s_I - y s_j + MK_2. \quad (1\text{-b})$$

$$K_1 + K_2 = 1.$$

$$K_1, K_2 \in \{0,1\}.$$

Inset *Relation (1)*, if:

$K_1 = 0$, demand is low, discount model is applied for hotel i,

$K_2 = 1$, since the value of M is a very large number, the constructed relation is considered as a redundant relation whose scale is not considered in the dimensions of the problem.

Therefore, taking into account the above assumptions using *Eq. (1-b)*, the demand model is created by considering the price discount and *Eq. (1-b)* is discarded. In this way, a discount model is applied, which is examined in this article. We also examine relationships related to the amount of hotel demand j under the terms of the discount. In the set of *Relation (2)*, like hotel i, we examine the model of hotel demand j under discount conditions.

$$\tilde{q}_J = (1-\mu)a - \gamma_j P'_j + d\gamma_j P'_I + \beta s_j - y s_I + MK_3. \quad (2\text{-a})$$

$$\tilde{q}_J = (1-\mu)a - P'_I + dP'_I + \beta s_j - y s_I + MK_4. \quad (2\text{-b})$$

$$K_3 + K_4 = 1.$$

$$K_3, K_4 \in \{0,1\}.$$

In the set of *Relation (2)* if:

$K_3 = 0$, demand is low, discount model applies to hotel j,

$K_4 = 1$, since the value of M is a very large number, the constructed relation is considered as a redundant relation whose scale is not considered in the dimensions of the problem. Therefore, taking into account the above assumptions using *Eq. (2-a)*, the demand model is created by considering the price discount. And *Eq. (2-a)* is discarded. In this way, a discount model is applied, which is examined in this article. Therefore, in the relations proposed in the set of *Eqs. (1)* and *(2)*, the discount model is applied only when $K_1 = 0$ and $K_3 = 0$. Considering the demand equations, we can also specify the revenue function for both types of the hotel i and j as follows. If $P'_{i,j} = \gamma_{i,j}(P_{i,j} + t)$ if γ is applied we can say that $\gamma_{i,j} P'_{i,j}$. So instead of showing $P'_{i,j} = \gamma_{i,j}(P_{i,j} + t)$ as $\gamma_{i,j} P'_{i,j}$ we show. Now, we write the income model in terms of $K_1 = 0$ and $K_3 = 0$ as follows:

$$\gamma_{i,j} P'_{i,j}; \quad P'_{i,j} = (P_{i,j} + t). \quad (3)$$

$$R_i = \gamma_i P'_i(\tilde{q}_i) - c_i(\tilde{q}_i) - c'_i - \frac{1}{2}\eta_i s_i^2. \quad (4)$$

$$R_j = \gamma_i P'_j(\tilde{q}_j) - c_j(\tilde{q}_j) - c'_j - \frac{1}{2}\eta_j s_j^2. \quad (5)$$

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Based on *Eqs. (4)* and *(5)*, the revenue model for i or j hotels can be calculated. If for the set of *Eqs. (4)* to *(5)* the value of $\frac{dR_i}{dP'_i}=0$, $\frac{dR_i}{dP'_j}=0$, $\frac{dR_i}{dq_i}=0$ and $\frac{dR_i}{dq_j}=0$ can be calculated then we can calculate the equilibrium points for P'_i, P'_j, q_i and q_j. For this purpose, we first consider $\tilde{q}_{i,j}=q$, $P'_{i,j}=P$ and $\gamma_{i,j}=Y$. In this case, the simplified equation of the income of hotels i and j is presented as *Eq. (6)*.

$$R=\left(Y.P.q\right)-cq-c'-\frac{1}{2}\eta_j s^2. \tag{6}$$

In *Eq. (6)*, the function R is a function with two variables P and q. Now, by deriving the *Eq. (6)* and inserting the estimated demand function, we can calculate the optimal value of each of the considered variables.

$$\frac{dR_{i,j}}{dP'_{i,j}}=Yq=0. \tag{7}$$

According to the value obtained in *Eq. (7)*, and by replacing $Y=\gamma_i$ and $\tilde{q}_i=q$, taking into account $k=0$, then the value of the equilibrium price of the hotel i in the discount conditions will be equal to *Eq. (8)*.

$$P_i'^{*}=(\gamma_i\beta s_i+\gamma_i ys_j-\gamma_i\phi\mu a)/((d-1)y_i^2). \tag{8}$$

Also, the equilibrium price of hotel j at the discount will be equal to *Eq. (9)*.

$$P_j'^{*}=\frac{-a\gamma_j+\gamma_j\mu a-\gamma_j\beta s_j+\gamma_j ys_i}{\left(d-1\right)\gamma_j^2}. \tag{9}$$

Also, by deriving from *Eq. (6)*, the optimal value of demand is calculated as *Eq. (10)*.

$$\frac{dR_{i,j}}{dq_{i,j}}=PY-c=0. \tag{10}$$

According to the value obtained in *Eq. (10)*, by placing $P'^{*}_{(i,j)}$ in this case, the amount of equilibrium demand for hotels i and j in the discount conditions is equal to *Eqs. (11)* and *(12)* will be.

$$q_i^{*}=\frac{\gamma_i\beta s_i+\gamma_i ys_j-\gamma_i\phi\mu a}{\left(d-1\right)\gamma_i^2}.\gamma_i-c. \tag{11}$$

$$q_j^{*}=\frac{-a\gamma_j+\gamma_j\mu a-\gamma_j\beta s_j+\gamma_j ys_i}{\left(d-1\right)\gamma_j^2}.\gamma_j-c. \tag{12}$$

4 | Research Results

To show the ability to implement the proposed model, we have considered three-star, four-star and five-star hotels in a tourist area in northern Iran. All these hotels are competing with every star they have to attract tourists. For example, two five-star hotels in the proposed model compete with each other. Some hotels are located in the city center and others close to the beach. Hotels offer a variety of green services and facilities, and some hotels use cost-effective methods that are higher in terms of hotel index, such as hotel i. However, the other hotels probably do not have a specific policy and do not use cost-saving methods such as hotel j. The parameters used in this research have been collected from surveys and interviews with hotel managers and hotel industry experts in Iran. The parameter values for each hotel are summarized in *Table 2*.

Table 2. Preset parameter values of 5-star, 4-star and 3-star hotels.

Paameters	c_i	c_j	c'_i	*	η_i	η_j	f	μ	β	y	d	s_i	s_j	a	γ
5 Star hotel	0.8	0.95	35	45	0.6	0.4	0.75	0.4	7	4	0.3	5	3	400	0.4
4 Star hotel	0.5	0.65	15	20	0.6	0.4	0.75	0.4	7	4	0.2	5	3	290	0.5
3 Star hotel	0.35	0.4	7	10	0.6	0.4	0.75	0.4	7	4	0.2	4	2	180	0.6

Based on the presented *Eqs. (8)*, *(9)*, *(11)* and *(12)*, we calculate the optimal amount of demand and price in terms of discount to calculate the optimal income based on the obtained values. *Table 3* shows the optimal results for the optimal amount of demand, price and income, taking into account the discount conditions.

Table 3. The optimal amount in terms of discount.

		5 Star Hotel	4 Star Hotel	3 Star Hotel
Hotel i	P'^*_i	28.40	10.56	69.01
	q^*_i	37.09	17.99	301.38
	R^*_i	40.38	23.87	555.65
Hotel j	P'^*_j	214	84.80	7141.52
	q^*_j	189.37	94.13	8835.65
	R^*_j	137.40	82.09	6721.11

The study hypothesizes that the government intervenes in possible decisions. In other words, it is assumed that the government as a leader seeks to maximize desirable performance. Therefore, the government can influence the price of hotels by imposing tariffs. For this purpose, the best hotel response based on government tariffs according to the utility relationship considered by Mousavi et al. [26], can be calculated as $U = \Omega.g + (1-\Omega)(\lambda f + (1-\lambda)h$.

In relation to desirability $g = q_i + q_j$; $f = t_i q_i + t_j q_j$ and $h = R_i + R_j$. Also, λ and Ω are two important and effective parameters in the performance of the utility function of the U state. The coefficient λ shows the importance of government revenue over hotel revenue. The coefficient Ω shows the importance of guest demand and attention to the expansion of the tourism industry. *Table 4* shows the effect of λ and Ω on the utility function of government U considering the government tariffs $t_{i,j}$ for 5-star hotels i, j.

According to *Table 4*, by increasing the values of λ and Ω at the same time, the value of the state utility function decreases sharply. Therefore, based on this initial study, it shows that the proposed model is sensitive to the values of λ and Ω. Therefore, their amount can not be reduced quickly .For example, if λ is kept constant and the value of Ω increases, it decreases with less intensity.

In contrast, by holding Ω constant and changing λ, the state utility function changes again with greater intensity. From the results obtained in *Table 3*, it can be concluded that the λ coefficient has a major impact on government profits of hotels. Based on this model, it can be concluded that if the λ coefficient increases, the state utility function decreases, so it is necessary to keep it as close as possible.

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Table 4. Parameter changes for 5-star hotels.

	λ	Ω	t_i	t_j	f	U
5 Star Hotel g=95.36;h = 7210.53	0.1	0.1	-9.2	-3.5	-393.952	5814.61
	0.2	0.2	-0.3	9.3	785.472	4759.487
	0.3	0.3	17.3	35.2	3167.648	4226.974
	0.4	0.4	70	113	10321.6	5111.119
	0.5	0.5	4.36	15.51	1361.29	2190.635
	0.6	0.6	-143.4	-198.6	-18355.6	-3194.44
	0.7	0.7	-90	-121	-11211.2	-1638.65
	0.8	0.8	-73.5	-96	-8916.96	-1062
	0.9	0.9	-67	-86	-8000.32	-562.1
	0.1	0.1	-9.2	-3.5	-393.952	5814.61
	0.1	0.2	-9.1	-3.4	-384.416	5179.9
	0.1	0.3	-9	-3.3	-374.88	4545
	0.1	0.4	-8.8	-3.1	-355.808	3910.482
	0.1	0.5	-8.6	-2.9	-336.736	3275.582
	0.1	0.6	-8.3	-2.6	-308.128	2640.682
	0.1	0.7	-7.8	-2.1	-260.448	2005.782
	0.1	0.8	-6.7	-1.8	-223.392	1369.716
	0.1	0.9	-3.6	2	131.584	736.0875
	0.1	0.1	-9.2	-3.5	-393.952	5814.61
	0.2	0.1	-0.5	9.2	774.88	5340.596
	0.3	0.1	17	35	3147.52	5402
	0.4	0.1	69	111.5	10183.84	7569.405
	0.5	0.1	1.04	-1	-73.8176	3221.057
	0.6	0.1	-140	-195	-18014.4	-7122.45
	0.7	0.1	-87.6	-118.5	-10973.9	-4957.15
	0.8	0.1	-70.2	-93	-8627.71	-4904.52
	0.9	0.1	-61.5	-80	-7433.44	-5362.6

In the following, the behavior of the proposed model for five-star, four-star and three-star hotels separately, taking into account the value of $\lambda = 0.01$ and for changes in the value of Ω between 0.1 to 0.9 for each of the five-star hotels, four stars and three stars are examined in *Table 5*.

Table 5. Sensitivity analysis of Ω on five-star, four-star and three-star hotels.

Hotel Type	λ	Ω	t_i	t_j	f	U
5 Star	0.01	0.1	-14	-10.5	-1038.24	6424.774
	0.01	0.2	-13.9	-10.4	-1028.7	5721.582
	0.01	0.3	-13.8	-10.3	-1019.17	5018.371
	0.01	0.4	-13.7	-10.2	-1009.63	4315.141
	0.01	0.5	-13.5	-10.1	-999.04	3611.897
	0.01	0.6	-13.3	-9.8	-971.488	2908.7
	0.01	0.7	-12.8	-9.4	-932.288	2205.483
	0.01	0.8	-12	-8.5	-847.52	1502.278
	0.01	0.9	-9.4	-6.4	-641.984	799.0245
4 Star	0.01	0.1	-10.4	-8	-940.268	8143.856
	0.01	0.2	-10.3	-7.9	-929.054	7251.532
	0.01	0.3	-10.2	-7.85	-922.548	6359.153
	0.01	0.4	-10.1	-7.7	-906.627	5466.817
	0.01	0.5	-9.9	-7.56	-889.849	4574.454
	0.01	0.6	-9.6	-7.3	-859.974	3682.11
	0.01	0.7	-9.2	-6.9	-815.12	2789.75
	0.01	0.8	-8.4	-6	-715.999	1897.41
	0.01	0.9	-13	-3.5	-563.441	1004.925
3 Star	0.01	0.1	-6.4	-5.4	-596.105	6488.839
	0.01	0.2	-6.3	-5.3	-585.508	5779.716
	0.01	0.3	-6.2	-5.2	-574.912	5070.572
	0.01	0.4	-6.1	-5.1	-564.315	4361.406
	0.01	0.5	-5.9	-4.9	-543.121	3652.273
	0.01	0.6	-5.7	-4.6	-513.719	2943.129
	0.01	0.7	-5.3	-4.2	-471.331	2233.966
	0.01	0.8	-4.4	-3.4	-384.169	1524.808
	0.01	0.9	-1.9	-0.8	-111.04	815.661

In the calculations performed, the equilibrium price, equilibrium demand and equilibrium income obtained according to the obtained relations have been used. The results show that in a competitive environment, government tariffs have a significant impact on hotel prices and hotel revenues. We know that the optimal prices for hotels and hotel revenues depend heavily on tariffs. Therefore, the government should carefully consider the hotel's reaction to tariff decisions. In a competitive environment, price changes not only affect the price of the hotel, but also the revenue of the hotel.

5 | Conclusion

The hotel industry is known as the largest subset of the tourism industry. Hotels of different sizes and situations are generally constantly competing with each other to attract tourists. In this regard, unexpected factors have a great impact on the performance of hotels in attracting tourists. For example, the widespread outbreak of the Covid-19 pandemic has affected many businesses around the world, including the tourism industry. In this case, the government, in order to overcome the fears of a decline in the tourism industry due to the pandemic, will impose its discount policies and regulations to develop a competitive advantage in order to improve the performance of the tourism industry. In this article, we have considered an attractive tourist area in the north of Iran, which has a large number of hotels. These hotels compete with each other to attract customers. In the proposed model, there are hotels with the same star that compete with each other with different hotel service indicators. Also, the discount rate on the price of each hotel room varies according to its star. Considering the defined conditions, we considered Stackelberg game with decentralized conditions in the model. In this situation, the leader influences the hotels by offering appropriate tariffs based on their goals and economic situation, and incentive policies in order to improve the hotel index. Therefore, the government helps hotels to attract tourists by setting different tariffs. Because increasing tourists can be a good source of income for hotels. The results show that the discount policies and regulations that the government imposes on hoteliers are able to force them to pay more attention to the competitive issue, which improves the performance of hotels. Because, with the development of the tourism industry and the encouragement of hotels to apply discounts on prices, there will be an increase in demand, so they will earn a significant net income. For future research, the use of dynamic demand models in calculating price and calculating the optimal demand is recommended. Also, the division of domestic and foreign tourists by considering the influential factors related to the elements of the demand equation will be useful.

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