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Pricing Strategies that Take into Account the Cost of Consumers' Time When Vehicle Join the Sharing Mode

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Abstract

With the rapid development of the sharing economy, people's ideas have changed from holding to using, which is more common in the area of sharing traffic (sharing bicycles, sharing cars, etc.). Although an increasing number of auto manufacturers are simultaneously offering consumers car for sales and for sharing, the adoption of sharing cars is not high. The main reason is that the service level of sharing cars is low, making consumers spend too much time searching sharing cars, which would cause consumers to transfer their travel modes. Therefore, we consider the length of time consumers who look for sharing cars. This study investigates the optimal pricing problem for car sharing and sales, and reveals how the waiting time affects the manufacturers' optimal decision. We have established a new model that takes into account the heterogeneity of consumers' time value. We found through analysis that the longer the average travel time of consumers, the lower the pricing of shared cars. When the waiting time for consumers to choose a shared car is closer to that of public transportation, the price of shared cars should be lower. At the same time, we found that as consumers wait longer to choose public transportation, the number of people choosing private cars will increase, and only when certain conditions are met will the number of people sharing cars increase. When consumers wait longer to choose a shared car, the number of people choosing a private car will increase only when certain conditions are met. Similarly, the number of people choosing a shared car will decrease when certain conditions are met.This finding enriches the existing literatures by providing novel perspectives on car sharing, and provides suggestions for manufacturer decision.

Keywords

Car Sharing mode, Pricing, Search-time, Time value.

1. Introduction

In recent years, with the rapid development of the sharing economy and the Internet, sharing products have begun to enter people's horizons and accelerate the process of urbanization. Modern sharing means that the right of usage is developed greatly without the transfer of ownership. For example, in a sharing car, the owner of the car places the car information on the Internet platform, and then the consumer makes a short-term lease. The common consumer only needs to register as a platform member to reserve the vehicle on the platform. Compared with the sharing bicycle that can only bear the "last mile" trip, the advantage of the sharing car is that it can bear the traffic of medium and long distance, which enriches the way people travel. At the same time, the emergence of sharing cars has also digested the stock of cars, making people make full use of idle resources, and alleviating traffic congestion by reducing the sharing of “one car” and reducing environmental pollution in cities. Sharing cars is very common in Europe and North America, but they are still a new wave in places like Asia.

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It first appeared in the form of a lease. In 1948, there was a “self-driving cooperative” in Switzerland, which was the original appearance of sharing cars [1].After that, global sharing cars came one after another. For example, brands such as Zipcar and Car2go competed with each other. Not only did they mature in the United States, but they also became the new favorite of young Americans, and they began to move to neighboring countries. For example, Car2go, the world's largest sharing carrier, has more than 20,000 sharing vehicles, including 3,000 electric vehicles, distributed in more than 30 cities and 13 countries [2].

Nowadays, most of sharing cars now use time or distance for charging, which includes all the expenses in the legal driving process, and members do not need to pay additional fuel, insurance and parking fees. According to statistics, the price of sharing cars is lower than that of taxis and other transportation modes without traffic jams. Compared with buying a car, the advantage of consumers choosing to share a car is that they do not have to bear a huge cost of car purchase, insurance, maintenance and parking. Compared with traditional leasing, consumers do not need to rent a car after using the car, just need to park it in the legal parking space of the nearest operating area. These characteristics have greatly attracted the young people who are now brave enough to receive new things. Meanwhile, it also attracted many car manufacturers and operators to join.

In the former sharing business (also known as leasing), a specialized leasing merchant purchase cars by from the manufacturer and then leased to the consumer. Automakers are now also joining the ranks of sharing who use the direct rent mode to lease cars to end users. Car manufacturers have a bigger advantage than leasing companies.

The active participation of sharing cars operators has led to explosive growth in the number of sharing cars. The quality of service provided by sharing cars will directly affect the experience of consumers. Some survey results show that: the layout of service outlets, vehicle placement relatively insufficient impact, users cannot do ‘stop and go, go with the use’, cannot really feel the sense of acquisition and satisfaction that sharing travel should bring. The user thinks that the

sharing car needs to be upgraded. Firstly, it is difficult to find service outlets, which makes the vehicle unable to be conveniently used and parked, which takes time and effort, accounting for 75%. Secondly, the amount of delivery is small, accounting for 69%. The third is to strengthen Maintenance of vehicles accounted for 56% [3]. Therefore, only by increasing the coverage of services can we increase the enthusiasm of consumers to adopt sharing cars and promote the rapid development of sharing economy.

Therefore, we find that for consumers, the factors that influence the way of travel include factors (such as the price and convenience) mainly refer to time saving. Through the research of related literatures, we find that previous scholars have studied the factors affecting the travel of consumers through qualitative analysis. We summarize and comprehensively consider the main characteristics of short-distance travel in cities, and determine the factors that influence the choice of short-distance travel modes, including punctuality; rapidity; economy; comfort and safety [4]. As shown in Figure 1. At the same time, according to the survey of different scholars, we find that among the five influencing factors, the importance of rapidity is the highest, while the waiting time takes the highest weight of the rapidity. Therefore, we can judge that finding and waiting time is an important factor affecting the choice of consumers' travel. For consumers, owning a car avoids waiting time, while choosing a sharing car requires a search-time.

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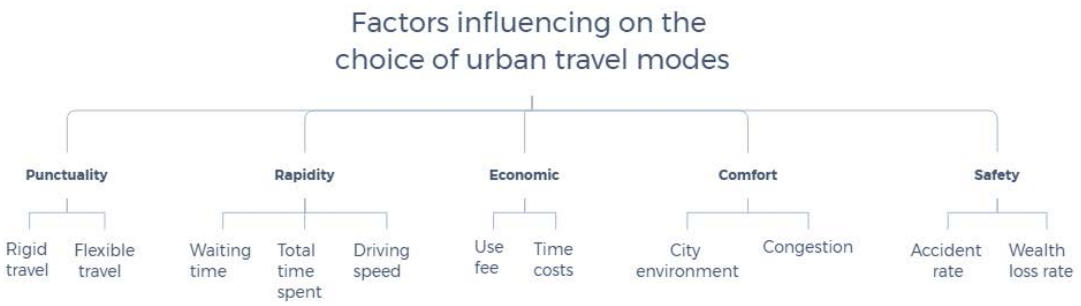

Figure 1 Factors Influencing on the Choice of Urban Travel Modes

In this paper, we study the optimal decision of the automaker in the sales mode and the leasing mode under the monopoly situation. From the consumer side, we consider the consumer's duration of use and time-value. The duration of the consumer's use reflects the actual demand for personal car purchase and car sharing, and the time-value reflects the individual's cherished time. From the manufacturer side, we consider the price, etc. offered by the car manufacturer. Because sharing cars can serve different people at different times, the number of cars is less than the number of consumers. Automakers only need to provide a certain percentage of the total number of vehicles. We introduce a problem of maximum profit to help decision makers decide how to make decisions in both modes. We use the sales price and sharing price of the car as the decision variables. The novelty of this paper is that we consider the impact of consumers' time of finding a sharing car on consumer choice. Therefore, we can enrich the existing literature on manufacturers' participation in sharing-mode decisions by considering the consumer waiting time.

The rest of this article is organized as follows: The second part is divided into two aspects to review the relevant literature, and the third part is the problem description, which includes automobile manufacturer decision-making problems and consumer choice behavior. The fourth part is to build the model framework. We divide it into two parts: the consumer decision model and the manufacturer decision model. The fifth part is the optimal strategy analysis, and the sixth part summarizes the paper and future research topics.

2. Literature Review

In recent years, with the gradual popularization of sharing cars, a large number of researches on sharing cars have appeared. In this paper, the research is mainly related to these second aspects: first, the factors influencing consumers to choose to share cars, and secondly, the study of decision-making issues after auto manufacturers joined the sharing mode. The literature for each section is reviewed below.

At the beginning of the development of sharing cars, scholars began to invest in the study of the willingness to use car sharing and its influencing factors. Among them, most scholars analyzed the willingness to use and its influencing factors of the sharing car through questionnaires, analytic hierarchy process and other methods. For example: Wang (2017) investigated the willingness of second-tier city residents to participate in car sharing by issuing questionnaires, and found that the main influencing factors are age, occupation, family monthly income, car expenses and whether the supporting services of sharing cars are perfect [5] . Jiang et al. (2015) found through research that the target market and consumer groups of car sharing organizations should be: those with moderate family economic conditions, no cars or plans to purchase a second car, less demand for cars, and more environmentally conscious people [6]. Zhao et al. (2018) found through logistic regression that age, education, car purchase policy, and environmental behavior are significant factors influencing consumers' willingness to purchase new energy vehicles, while the nature of work units, sales services,

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and vehicle performance have little effect on car purchase willingness. Therefore, the government and enterprises should focus on promoting new energy vehicles among highly educated young people, raising people's awareness of environmental protection, and increasing the preferential policies for car purchases [7]. Kang et al. (2016) analyzed the factors affecting the willingness of consumers to share the use of cars based on data from two car-sharing companies in Seoul, and concluded that young people between the ages of 20 and 30 have a higher demand for car sharing. Travelers near the business district and in areas not covered by the subway use a large proportion of car sharing, and increasing the number of points sharing by cars will promote more people to choose car sharing [8]. Lorimier et al. (2013) used the data of the car sharing company Communauto to establish a linear regression model to determine the factors that influence the willingness of consumers to share their cars. They found that the size of the operating outlets and the vehicle conditions (such as the degree of use of the vehicle, whether there is a baby seat, etc.) will affect the willingness of the traveler to share the car [9]. Shaheen et al. (2013) investigated the willingness to use electric vehicle sharing among residents of the elderly community in Walnut Creek, California, and concluded that electric vehicle sharing has great potential for development in older communities [10]. Guajardo (2012) considers factors that influence consumer choice mainly include product quality, service quality, and warranty [11]. Efthymious et al. (2013) conducted a survey on the willingness of young people in Greece to share their use of cars, and found that travel time, age, income level, environmental awareness and other factors have a greater impact on consumers ' choice of car sharing [12].

This article divides the main body into manufacturers and consumers. The factors that influence manufacturers' influence on consumers are mainly price and service level[13]. Service level affects consumer search time. At the same time, the factors that influence the travel of consumers are their own time-value and the use of cars in a fixed time. We have learned from the previous scholars' research that the two main factors affecting consumers are price and time. And represent it in the utility function.

The second part is to consider the decision-making research of automobile manufacturers under the sharing mode. Due to the rapid development of the Internet and the sharing economy, automobile manufacturers rely on their own advantages, more and more enterprises introduce sharing cars as their own business, thus Inspiring more scholars to join the research on the car manufacturer's sales mode to consider the issue of leasing (sharing mode) strategy. The earliest study of automakers adding in the sharing-mode strategy was the work of Gilbert et al. (2014). They considered that a monopoly company leases products by usage while selling durable goods, and found that even if the products sold and rented were substitutes, providing a sales mode can also slightly increase the price of a rental product, while providing the rental mode may increase or decrease the optimal price for sales [14]. Yu et al. (2018) studied how manufacturers simultaneously consider the interaction between two modes and degenerate into a single mode. They find that when the vertical difference of products falls into an interval, the manufacturer's rental mode is more profitable than sales mode [15]. Agrawal et al. (2017) believe that without a pooling effect, production may leads to higher environmental impacts, and sharing would reduce environmental impact. In contrast, the hybrid business mode also has environmental advantages under a powerful pooling effect. However, pure sharing modes are not good for the environment in terms of high production costs, because even in the strong pooling effect, it leads to greater production [16]. Abhishek et al. (2017) analyzed the interaction between the leasing market and automobile manufacturers, and emphasized the important role of consumer heterogeneity in the frequency of use, and found that when consumer usage (the duration of use) is low Suitable for P2P. It is not necessarily advantageous for automakers to introduce a sharing mode with P2P competition. Contrary to expectations, automakers may also promote P2P leasing [17].

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Jiang (2015) considers that consumers can rent out idle cars when the sharing platform rent is high. They find that the transaction costs in the sharing market have a non-monotonic effect on the company's profits, consumer surplus and social welfare. When companies strategically choose retail prices, consumers who share high marginal cost products are successful. They share a product with low marginal cost may be a lose-lose situation. In addition, in the presence of the sharing market, the company found that it is best to improve its quality strategically, thereby achieving higher profits but reducing consumer surplus [18]. Chen (2001) divides the quality of products into basic product quality and green product quality, and divides consumers into environmental consumers and ordinary consumers. It analyzes the strategic decision of manufacturers to introduce the quantity of environmentally friendly products and their price and quality. Green product development and stricter environmental standards may not necessarily benefit the environment [19]. Agrawal (2012) believes that leasing is not necessarily environmentally friendly, and in some cases, levying a disposal fee or encouraging remanufacturing can actually have a higher environmental impact. It is also determined when educating consumers to be more environmentally conscious can increase the relative environmental performance of leasing [20].

This article has similarities with previous studies, and there are differences. Although the manufacturer's decision-making problem has been previously studied in various views, the key influencing factors about consumers' cherishment of time is not consider in detail. This article focuses on the impact of time costs on manufacturer decisions and consumer choice.

3. Problem Description

We consider a system in which a monopoly manufacturer can provide consumers with sharing cars and sales simultaneously. Consumers can choose to buy a car, rent a car or take public transportation (bus, bicycle, etc.). We use subscripts r, s and p to indicate renting car, sales and public transport, respectively. The sequence of events is as follows. First, the manufacturer obtains the behavior information of the consumer through the pre-delivery of the cars, and then the manufacturer announces the sales price and sharing price in a new period that needs to be provided. After obtaining the manufacturer information, consumers re-select travel mode based on their utility.

3.1. The Manufacturer's Decision.

The manufacturer aims to maximize his total profit from sales and car sharing. First, we use p_r and p_s to denote the prices in car sharing and sales respectively. Consumers can only use car sharing when they become sharing cars members. Membership fees are negligible compared to travel expenses. We assume that car- sharing consumers can always find cars, just looking for differences in time. The car production cost of the manufacturer is denoted by c_i, $i \in$ (r, s).At the same time, we consider that sharing cars and private cars travel at the same speed and are greater than the speed of public transportation. When consumers choose to share a car, the manufacturer retains the ownership of the car. After sharing in a fixed time, the manufacturer can also use the good parts of the sharing car for the production of new cars, or modify used cars and sell them, the salvage value is expressed by ε_r.

3.2. The Consumers' Decision.

Consumers choose any way of travel that stems from rational choice. The external factors are mainly the prices. The subjective influencing factors are mainly the consumers' own cherishment of time and the use of cars. We denote the Consumer cherishment of time as time-value by ω, and use a certain value lower than consumer' salary in a unit time to represent time-value. We denote the duration of using a car by λ, usage refers to the length of time consumers use a sharing car in a fixed time. $\tau_1$represents the time consumers spend

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looking for a shared car, τ_2 represents the waiting time for consumers to take public transportation. n represents the number of times a consumer uses a shared car over a period of time, n_1 is the number of times consumers have taken public transportation in a period of time.

We assume that consumers are heterogeneous in terms of their time value, which is uniformly distributed from 0 to 1[23]. The market size in our model is normalized to 1 without loss of generality. The maximal usage in the market is normalized to one. Thus, the consumer with ω= 1 has the maximal time value, whereas the consumer with ω= 0 have minimal time value. When a consumer chooses to buy a car, he or she acquires ownership of the car. After a period of use, the consumer can sell the used car, which is called the salvage value of the car, expressed as ε_s.

4. Model Formulation

4.1. Customers' Utility.

1) Consumer utility from choosing sales. The base utility λv is that customers derive from satisfying their mobility needs, and the cost is the sales price p_s of the car. Therefore, the consumer's utility formulation is:

$$U_s = \lambda v - p_s + \varepsilon_s \tag{1}$$

2) Consumer utility from sharing a car. Similarly, the basic utility of satisfying consumer mobility needs is λv, the losses that consumers need to bear mainly include driving costs and time costs. The driving cost of a consumer who chooses car sharing depends on the usage and the firm's per-unit-of-time price and we formulate it by λp_r. The time cost of a consumer is expressed as $n\tau\omega$, Where $\tau\omega$ represents the time cost of the consumer renting once. Therefore, the utility is

$$U_r = \lambda v - \lambda p_r - n\tau_1\omega \tag{2}$$

Since the precondition for consumers to make decision is that their utility is more than zero, the conditions are strictly met $v - p_r > 0$.

3) The utility from taking public transportation. When consumers choose public transportation (only considering buses), the utility that meets the most basic travel needs is λv. Consumers also need to bear the driving costs and time costs, because bus fees are less than sharing and buying cars, so can be ignored. However, the time spent on public transportation is longer than the time spent on shared cars and private cars due to stops at the station and the suboptimal route. We present the total time cost of n_1 rides by consumers as $n_1\tau_2\omega$. The general expression of the utility of public transportation is as follows:

$$U_p = \lambda v - n_1\tau_2\omega \tag{3}$$

4.2. Market Segmentation.

Now, we can use consumer utility to analysis the market. Q_s,Q_r and Q_p indicate the number of people who buy a car, use sharing cars, and take the public transportation, respectively. We assume that the time value is uniformly distributed from 0 to 1, and denote the marginal renter (MR) and the marginal buyer (MB) by ω_1 and ω_2, respectively, where MR is indifferent concerning public transportation and sharing cars, and MB denotes indifferent between sharing cars and sales.

We have $\omega_1 = \{\omega | U_r(\omega) = U_p(\omega)\}$,$\omega_2 = \{\omega | U_r(\omega) = U_s(\omega)\}$, which implies that both ω_1 and ω_2 are functions of p_r and p_s. According to Equation (1) , (2) and (3), we can get

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$$\omega_1 = \frac{\lambda p_r}{n_1\tau_2 - n\tau_1} \tag{4}$$

$$\omega_2 = \frac{p_s - \varepsilon_s - \lambda p_r}{n\tau_1} \tag{5}$$

Consumers with $\omega \in [0, \omega_1]$ choose public transportation that is not covered by the manufacturer. Consumers in $\omega \in (\omega_1, \omega_2)$ choose to share a car. Consumers in $\omega \in [\omega_2, 1]$ are buyers who choose sales. Therefore, the number of three segments is:

$$\begin{cases} Q_s = 1 - \omega_2 \\ Q_r = \omega_2 - \omega_1 \\ Q_p = \omega_1 \end{cases} \tag{6}$$

Because price and marginal time value have a functional relationship, the demand is also a function of price.

4.3. Manufacturer' Profit.

The manufacturer's problem is how to decide p_s and p_r for his car under the two business modes. The manufacturer aims to maximize his total profit from sales and car sharing.

1) The firm profit under the sales business mode

In this case, the manufacturer's revenue depends on the sales price and cares demand. The key here is that the demand $Q_s(p_s, p_r)$ is a function of both the sharing price p_r and sales price p_s. Thus, the manufacturer's profit is the revenue minus the cost.

$$\pi_s(p_s, p_r) = Q_s(p_s, p_r)(p_s - c_s). \tag{7}$$

2) The firm profit under the sharing business mode

In this case, the manufacturer's profit mainly depends on the travel expenses charged to consumers and their usage amount. We assume that the level of service provided by the manufacturer is certain, so the number of shared cars that the manufacturer needs to provide is related to demand. We use $S = \theta\ Q_r(p_s, p_r)$ expressing the sharing cars he provided. the cost of producing sharing cars by the manufacturer is Sc_r, and the salvage value of the manufacturer after recycling the car is $S\varepsilon_r$. We formulate the revenue from car sharing by calculating the aggregate usage of the sharing segment, which is denoted by $\Omega = \lambda Q_r$, which implies that the firm's car sharing revenue is Ωp_r.So the manufacturer's profit is the revenue minus the cost, and add the salvage value.

$$\pi_r(p_s, p_r) = \lambda Q_r(p_s, p_r)p_r - \theta Q_r(p_s, p_r)(c_r - \varepsilon_r). \tag{8}$$

3) The firm total profit from the two segments is $\Pi(p_s, p_r) = \pi_s(p_s, p_r) + \pi_r(p_s, p_r)$, which leads to the following optimization problem.

$$\max_{p_s, p_r} \Pi(p_s, p_r) = Q_s(p_s, p_r)(p_s - c_s) + \lambda Q_r(p_s, p_r)p_r - \theta Q_r(p_s, p_r)(c_r - \varepsilon_r). \tag{9}$$

It is obvious that we have to analyze the consumer time value, demand (Q_s,Q_r and Q_p) further and their important effect on the prices in detail to obtain the manufacture's optimal strategies.

5. Optimal Strategies

We obtain the optimal decision price by solving the manufacturer's profit function. By verifying that Π is a concave function of p_s, p_r, the automaker has a unique maximum point. Find the first-order partial derivative of the manufacturer 's revenue function with respect to the retail prices of the two modes of travel. Let $\delta_1 = n\tau_1$,$\delta_2 = n_1\tau_2$ and δ_1 represent the total

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waiting time for consumers to choose a shared car over a period of time. It is more time than buying a car. δ_2 represents the total waiting time and stopping time for choosing public transportation in a period of time. We can get the best pricing from car manufacturers for private cars and shared cars:

$$p_s = \frac{(c_s+\varepsilon_s)(\delta_2-\delta_1+1)}{2\delta_2} + \frac{\delta_1}{2} - \theta(c_r - \varepsilon_r) \quad (10)$$

$$p_r = \frac{(c_s+\varepsilon_s)(\delta_2-\delta_1)}{2\lambda\delta_2} - \frac{\theta(c_r-\varepsilon_r)}{2\lambda} \quad (11)$$

From the above formula we can get the following propositions:

Proposition 1: (a) The longer the average use time of consumers, the lower the price of shared cars. (b) The closer the consumer 's waiting time δ_1 for choosing a shared car to the waiting time δ_2 for public transportation, the lower the price of a shared car.

The main reason is that if consumers travel for a long time, at the same time, the high per unit time price will cause consumers to bear higher fees, compared to public transportation, no matter how long the travel time, their travel costs are the same. Compared to private cars, the longer the travel time, the less the cost of each trip will be shared. Therefore, when consumers in the market travel longer on average, automakers should reduce the unit time cost of shared cars to increase competitiveness.

In Proposition 1, we assume $\delta_2 > \delta_1$, so the closer the two waiting times of δ_1 and δ_2 are, the lower the price of the shared car should be. For consumers, choosing a private car means that the time cost of waiting is almost zero. At this time, if the waiting time for shared cars and the choice of public transportation is very close, consumers are not willing to spend more money on sharing car. But if car manufacturers are willing to reduce the unit time price of shared cars, they can avoid the mass loss of consumers in the shared car market.

We substitute equations (10) and (11) into equations (4) and (5), and we can get the market demand for choosing shared cars and private cars:

$$Q_s = \frac{\delta_1\delta_2 - (c_s+\varepsilon_s) + \theta(c_r-\varepsilon_r)\delta_2 + 2\delta_2\varepsilon_s}{2\delta_1\delta_2}$$

$$Q_r = \frac{(c_s+\varepsilon_s)(1-\delta_1)}{2\delta_1\delta_2} - \frac{\theta\delta_2(c_r-\varepsilon_r) + 2\varepsilon_s(\delta_2-\delta_1)}{2\delta_1(\delta_2-\delta_1)} + \frac{1}{2}$$

Proposition 2: (a) The longer the waiting time δ_2 for consumers to choose public transportation, the more people choose a private car. (b)When $\frac{(c_s+\varepsilon_s)}{\delta_2} - \delta_1 < 2\varepsilon_s + \theta(c_r - \varepsilon_r) < 0$ is satisfied, as the waiting time δ_1 of the shared car increases, the number of people choosing a private car is bound to increase. (c) The longer the waiting time δ_1 for consumers to choose a shared car, the fewer people choose to share a car when $\delta_2 < 2\delta_1$ is strictly met. When $\frac{(\delta_2-\delta_1)(1-\delta_1)}{\delta_1\delta_2} < \frac{\theta(\varepsilon_r-c_r)}{(c_s+\varepsilon_s)}$ is satisfied, there must be an increase in public transport waiting time δ_2, which will lead to an increase in the number of shared cars.

The longer the waiting time for choosing public transportation, consumers will shift to other ways. At this time, no matter the waiting time for shared cars increases or decreases, the number of consumers choosing private cars will increase. When the shared car waiting time is longer, consumers will shift to buying a car, but when the shared car waiting time is short, a small number of consumers will also choose a private car in order to obtain car ownership or increase comfort .

When a certain condition is satisfied between the waiting time δ_2 for public transportation and the waiting time δ_1 for shared cars, the increase in waiting time for shared cars will inevitably lead some consumers to transfer to private cars, which will increase the number of people who buy cars.

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When the condition $\delta_2 < 2\delta_1$ is satisfied, as the waiting time for consumers to choose a shared car increases, the number of people choosing a shared car will gradually decrease. This is because the waiting time of public transportation is not much different from the waiting time of shared cars, but the cost of shared cars is higher than that of public transportation, so the increase in waiting time will cause consumers to shift to other modes of travel. When the waiting time for choosing public transportation is much longer than the time for choosing a shared car, that is, if $\delta_2 \gg 2\delta_1$ is satisfied, as the waiting time of the shared car increases slightly, the number of people who choose to share the car will still increase. This is because consumers at this time realize that the low cost of public transportation cannot balance the long waiting time and shift to shared cars and private cars.

We found that only when the waiting time δ_1 of the shared car and the waiting time δ_2 of public transportation meet certain conditions, that is, the closer the two waiting times are, the easier it is to satisfy the condition. On this basis, when the waiting time of public transportation increases, consumers will immediately notice the change in waiting time, so that the number of car sharing can increase. If the waiting time of public transportation is much longer than the waiting time of shared cars, and consumers still choose public transportation at this time, it must be because consumers care more about travel costs than time costs. At this time, the waiting time of public transportation will increase, and it will be difficult to change consumer choices. As a result, the number of people who choose to share a car will not increase.

6. Conclusion

With the rapid development of sharing cars, many car manufacturers realized their own advantages and find that sharing cars are profitable, so they considered the sharing mode in the original sales mode. The equilibrium pricing of manufacturer in two modes has become a hot issue for scholars. We develop a model to study the pricing strategy of manufacturer under sharing mode and sales mode.

The innovations of this paper are as follows: First, method innovation. Previous studies have used the consumer's time to divide the consumer market. However, when considering the optimal strategies of manufacturers under the two modes, it is impossible to get the exact Optimal price analysis. And this paper uses the value of time to classify consumers, which can not only reflect the consumer's economic status, but also reflect the consumer's cherishment of time. The second point is based on the consideration of the price and the length of use in the past. This paper considers the impact of consumer waiting time on car sharing and choice of public transportation on decision-making. It further analyzes the impact of waiting time on the optimal pricing of the manufacturer and consumer choice.

We found that although the brand and number of car sharing has increased year by year, consumer enthusiasm and acceptance of car rental are not high. The survey found that search time for shared cars is the number one factor influencing consumers' choice of sharing model. Different from other scholars who study the pricing of car sharing, we find that consumers' willingness to rent a car has time value in addition to the use time. Therefore, we considered the impact of car rental time costs on consumer choices and the decisions of manufacturers.

In our model, consumer search time may affect both consumers and manufacturers. For consumers, finding time affects their choices about how to travel. For manufacturers, finding time affects the optimal pricing they share and so on. But this article is only a limited analysis of the effect of search time on the manufacturer's strategy. Future research should analyze the remaining factors of consumer time cost in combination with actual conditions. For example, this article breaks down the consumer market by time value. It is impossible to judge the influence of this parameter on the optimal decision. In fact, as people pay more and more

attention to the time factor, the impact of consumers' time value on the choice of travel mode is very important. Therefore, in the future, time values can be regarded as parameters and their impact on decision makers can be analyzed.

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