



## Article

# Evaluating Consumers' Willingness to Pay for Delay Compensation Services in Intra-City Delivery—A Value Optimization Study Using Choice

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**Abstract:** Intra-city delivery has developed rapidly along with the expansion of the logistics industry. Timely delivery is one of the main requirements of consumers and has become a major challenge to delivery service providers. To compensate for the adverse effects of delivery delays, platforms have launched delay compensation services for consumers who order. This study quantitatively evaluated consumer perception of the delay compensation service in intra-city deliveries using a choice experiment. We explored how different attributes of the delay compensation service plan affect consumer preference and their willingness to pay for the services. These service attributes are “delay probability display”, “compensation amount”, “compensation method”, “penalty method for riders”, and “one-time order price”. Using a multinomial logit model to analyze the questionnaire results, the respondents showed a positive preference for on-time delivery probability display, progressive compensation amount, and cash compensation. The results also show that the respondents opposed the penalty scheme where the riders would bear the compensation costs. Positive preference attributes are conducive to enhancing consumers' willingness to order and pay for the program. Based on our findings and research conclusions, we proposed several recommendations to improve the delay compensation service program.

**Keywords:** light city logistics; intra-city delivery; delay compensations; willingness to order; choice experiment



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## 1. Introduction

With rapid developments in mobile Internet, the collaboration of e-commerce, media, and logistics platforms has brought tremendous changes to people's shopping experience [1]. At the same time, Logistics companies have integrated technologies, such as the Internet of Things, cloud computing, and artificial intelligence, to develop new competitive advantages [2]. Given this industry environment, the intra-city delivery, a city-wide short-distance light logistics distribution, has emerged. Under the business model of the intra-city delivery, it can realize the Online to Offline (O2O) model of multiple categories, such as takeaway catering, fresh groceries, medical drugs, and door-to-door services, through Business to Customer (B2C) or Customer to Customer (C2C) businesses, such as online booking, order placement, and offline consumption. Therefore, we define intra-city delivery in this paper: intra-city delivery is an express delivery service carried out by logistics companies for senders and recipients in different areas of the same city.

As the Internet consumer market becomes more segmented, user needs have become more refined. The intra-city delivery can provide consumers with a more efficient and professional service and added convenience in the last mile delivery. In China, the rapid growth of the intra-city delivery market has propelled the creation and growth of numerous

urban logistics service companies, such as Fengniao Distribution, Xindada, and Meituan Distribution. By the third quarter of 2019, the transaction scale of the intra-city distribution market in China reached 79.52 billion yuan with 470 million users [3]. Therefore, the intra-city delivery has become an important segment of light city logistics with huge market scale and development potential.

From the perspective of practice, delivery time and delivery delay are one of the most important problems affecting consumer experience in light city logistics industry such as the intra-city delivery. In delivery services, merchants would need to agree with the consumers on the estimated delivery time and ensure delivery timeliness. If the products are not delivered on time, consumer satisfaction with services is significantly reduced [4]. Due to the characteristics of the products, the demand for timeliness in intra-city distribution is considerably greater than regular express logistics [5]. Research has shown that among the user experience factors in intra-city delivery, 52.4% of the respondents consider the immediateness of delivery as their primary concern [3]. Similarly, according to survey statistics, one in five consumers check their phones to track their food delivery's real-time location, at least once. This behavior reflects how consumers are extremely sensitive to the timeliness of delivery [6]. Delays in delivery services would negatively impact users' waiting emotions, causing them to experience pain points.

To meet the demand for prompt and timely delivery, platforms may need to increase the number of distribution personnel, which would result in substantially higher distribution costs [7]. Efficient supply chain management includes high-quality customer service and efforts to reduce circulation costs [8], and cost control is a key point in platform operations. In many instances, cost constraints may be the reason for intra-city delivery delays (i.e., due to cost constraints, the delivery staff is insufficient, and the single delivery time exceeds the scheduled period), causing a decline in consumer satisfaction and willingness to repurchase. Therefore, in the case of reducing the cost of distribution, it is particularly important to improve the service quality of distribution.

To reduce consumer dissatisfaction, reduce the cost of distribution, and compensate for the negative effects of delays, intra-city distribution platforms often launch delay compensation services for consumers to choose from. When delays occur, the platform will compensate a certain amount according to the corresponding plan to counteract consumer dissatisfaction and indicate corporate responsibility. For example, the three companies that occupy the top of the intra-city delivery, Fengniao Distribution, Xindada, and Meituan Distribution, have launched various delay compensation services Zhunshida, Zhunshibao, and Weichangzhun. The delay compensation service is a good response to counteract the anxiety caused by waiting, especially waiting without a clear duration [9]. Research has shown that as the total value consumers receive from services goes up, the shorter the consumers perceive the waiting time [6]. This can effectively reduce their anxiety and helplessness. Providing delay compensation has become an effective approach to minimize perceived waiting time [10] and reduce consumer anxiety. However, we still do not know the extent of consumers' preference for the attribute in delay compensation service for intra-city delivery, which will affect consumers' willingness to pay for delay compensation service.

Compared with other methods, choice experiment (CE) can accurately measure consumers' preferences for important attributes of a product and provide more information about the attribute preferences when consumers make product choices [11]. Therefore, CE is suitable for this study to detect consumers' preferences for different attributes of delay compensation service for intra-city delivery as well as consider the influence of different social demographic factors on the attribute preferences of consumers. To the best of our knowledge, this is the first study to research the preferences for delay compensation service. Using choice experiment to analyze consumer behavior, this study focuses on the delay compensation service plan in intra-city delivery. A questionnaire survey was conducted to obtain first-hand data on users' preferences for attributes of delay compensation services. A multinomial logit model was used to calculate user preferences and willingness to pay

for different service attributes and find the optimal attribute combination. We also explored the correlation between the users' socio-economic profile and five service attributes: delay probability display (none, 99% arrive on time, 1% delay), compensation amount (fixed amount, progressive amount), compensation method (cash, voucher), penalty method for riders (none, rider bears the compensation, reduce rider's credit score), and the one-time order price (0.3 yuan, 0.6 yuan, 0.9 yuan, 1.2 yuan). Based on the results, suggestions for platforms to improve delay compensation service for intra-city delivery are proposed.

## 2. Literature Review and Hypotheses Development

### 2.1. Service Innovation of Intra-City Distribution

Previous studies have found that price is an economic factor that determines people's loyalty to light logistics services [12]. However, as the light industry logistics service has gradually entered the mature stage, that is, the market saturation and enterprise scale are becoming more and more perfect, it is difficult for enterprises to compete for new consumers and distinguish themselves from competitors through a simple price war. Therefore, from price competition to user experience competition, optimizing user experience and improving subjective feelings have become important mechanisms to improve a competitive advantage [6]. Intra-city distribution can increase the complexity of services or enhance the perceived value of services to improve consumer satisfaction, thus creating competitive advantages [13]. In a word, increasing the service experience of consumers is an important way for light logistics enterprises to compete in the future.

User experience is a dynamic process [14], which is affected not only in the actual use or consumption of a product but also by the entire product-service [15]. Therefore, many scholars focus on the optimization of consumer experience of intra-city distribution, and scholars have studied experience of intra-city distribution from different perspectives, including the competitive advantage of service experience [16], the influence of service experience on repurchase intention [17], the formation of consumer satisfaction [18], the personalized logistics service function [19,20], and the differentiated service advantage [21]. Specifically, related [16] research shows that the service quality of intra-city delivery is the biggest competitive advantage in the industry. Its quality and effect determine consumer satisfaction, directly impacting users' willingness to repurchase on platforms [17]. These factors can also affect users' decision-making processes, such as cognition and evaluation of platforms, thereby increasing user satisfaction and forming a new ordering behavior [18]. Functional modules, review systems, and personalized logistics service functions [19] have become the main technical carriers to improve service quality. These service innovations can improve competitiveness and meet more individualized use needs [20] that give logistics service companies differentiated advantages [21].

It is necessary to improve the service experience of consumers through the service innovation or technology of logistics. For example, in conjunction with planned behavior, a related study examines the phenomenon of food delivery services from the perspective of mobile app users, as well as the primary motivations that lead consumers to use and recommend these technology-based services. The researchers found that perceived control is only important for older customers, who need to perceive that they control the apps before they will recommend them to other customers [22]. At the same time, logistics service innovation involves changing existing service processes and products using new technologies and knowledge in order to improve the quality of existing services, expand service contents, or increase the added value of logistics services [23,24]. Therefore, delay compensation service is not only the innovation of logistics service but also an effective tool to improve consumers' perceived control level of logistics delivery time.

Delay compensation service belongs to the value-added part of the distribution system [25]. Delay compensation service, similar to other parts of logistics service, will affect users' perception of service value [26], and delay compensation service will also be an important manifestation of logistics service quality. A compensation service with reasonable configuration can help improve users' perceived usefulness or ease of use for the

service, which is important in enhancing the level of user service exposure [5]. Conversely, if the design of a compensation service is unreasonable, and the perceived usefulness is poor, it will not encourage users to order, and the service will be useless. Moreover, unreasonable compensation service settings may be counterproductive and even increase user dissatisfaction. Previous studies have analyzed the importance of logistics service innovation [25,26]. However, previous studies have not analyzed how to optimize and design logistics services, especially logistics compensation services, from the perspective of consumer experience. Therefore, although the delay compensation service can affect the consumer's value perception of the service, there is no research on the optimization of logistics compensation services.

Studies have shown that dissatisfaction, generated by long waiting times, can easily give service providers a negative reputation through word-of-mouth [27]. However, much of the research on distribution platforms focuses mainly on price, category, convenience, or customer service [28]. The delay compensation service has often been excluded. In particular, the analysis of major attributes in delayed service (i.e., delay probability display, compensation amount, compensation method, penalty method for riders, and one-time order price) is unknown. So, this article addresses this oversight and focuses on evaluating the effects of delay compensation service plans in the inter-city logistics service industry.

## 2.2. Delay Compensation Service for Intra-City Delivery

Product delivery time is one of the main factors that affect consumers' repeated purchase decision and satisfaction [29]. The delayed delivery of online shopping goods will negatively affect consumers' satisfaction with e-commerce enterprises, and in the process of service recovery, material compensation can increase consumers' satisfaction and prompt consumers to change their subsequent behavior [30]. So, as a service innovation, the core of the delay compensation service is to provide a remedial plan to reduce the negative impact caused by service failures [2] in order to maintain consumer loyalty and trust. Studies have shown that the form of refund or compensation can reduce consumer complaints to a certain extent [31]. The service remediation paradox believes that if a certain amount of compensation is given for service failures (e.g., delivery overtime) and the issues get satisfactorily resolved afterward, consumers tend to have better service experiences or higher satisfaction [32]. However, how the delay compensation service can satisfy consumers and generate a certain service experience has not been fully studied in the academic research field.

Delay compensation service is an active type of compensation. Compared with the passive form, this system can create more positive emotions and higher user stickiness [33]. However, 40% to 60% of users are not satisfied with most compensation services, which is often due to a faulty or ineffective compensation process [34]. Therefore, designing a fair and reasonable delay compensation service plan with strong compensation effectiveness can reduce complaints and increase consumer satisfaction and trust in platforms. It's also a great way to create a user experience [6].

Different from the relative lag of academic research, the logistics service industry has formed a number of attributes of delayed compensation service in a large number of practices as well as designed different schemes of delayed compensation. For the delay compensation service plan, each platform may have different attributes and attribute levels. For example, in terms of the type of compensation, Zhunshibao of Meituan pays a cash balance, while Zhunshida of Fengniao pays red envelopes. In terms of compensation value, Meituan's compensation is based on delay time and increases in a stepwise manner, while Xindada pays a fixed amount. Can these different attributes and levels better alleviate users' dissatisfaction with delays, and can they attract users to order delay compensation services? The effectiveness and usefulness of these compensation systems to increase user satisfaction and consumer loyalty are integral in the future developments and improvements to the intra-city logistical service industry. Therefore, we need to study these attributes for the

first time and use CE to determine the impact of different attributes and levels in these services on users' willingness to order.

### 2.3. User's Willingness to Order

As a value-added service, delay compensation service requires a certain degree of subscription by users to take effect. Therefore, compensation services need to stimulate consumers' willingness to order in order to form a corresponding effective transaction. Related studies have shown that in the context of e-commerce, some subtle transaction factors, such as the payment method for delivering cash, affect consumers' preference for e-commerce platforms. This also illustrates the importance of optimizing the elements of the trading scheme in trading [35]. Therefore, the influencing factors of purchase intention and satisfaction of intra-city delivery service are studied and analyzed. For example, Chen [36] confirmed that the user-friendliness of platforms, the convenience of operation, the timeliness of information, and the reliability of services are the main factors improving users' perceived value and satisfaction. Gao [37] studied the impact of platform usability, service response, and information content on user perception using the O2O model based on the American Customer Satisfaction Index (ACSI) theory. Zeng [28] proposed a fuzzy evaluation model of customer satisfaction in O2O delivery and found that there are three influencing factors in consumer satisfaction: food factor, price factor, and service factor. Jiang [38] found that using a fast and efficient website in order distribution can improve user satisfaction and increase their willingness to repeat consumption. He [39] concluded that safety and speed are critical factors in the online distribution industry and found that logistics and distribution services are the primary bottlenecks. While these studies were able to analyze user satisfaction and willingness to order in intra-city delivery in terms of information reliability, usability, convenience [36], service factors [37], food factor, price factor, and service factor [28], and efficiency [38], the willingness to order delay compensation services have been overlooked, particularly in relation to how they affect the perceived value of the order itself.

A major goal of service design is to increase the consumer's willingness to pay, which is inextricably linked with the value or attitude that consumers perceive for the service [40] and is mainly associated with consumer trust. In other words, trust is an important bridge to improve consumers' perception of service value. Trust is a safe, reliable, and effective positive expectation [41]. Relevant research studies show that the determinants of network trust include website characteristics, customer characteristics and other factors. Results include behavioral intention, stakeholder satisfaction, loyalty, traffic, price, revenue, profitability, etc. [42]. At the same time, six factors can improve users' trust in e-commerce, including payment choice, punctuality, after-sales service quality, and so on [43]. In other words, trust is the bridge between the service plan and the purchase intention, and in the process of forming this expectation, consumers require experience or external information (e.g., content information contained in the delay compensation service) to build trust in an object. However, uncertainties and perceptions of risks can have significant impact on consumer trust [44]. Strategies, such as stipulating truthful estimates for delays and providing clear compensation amounts, can be used to reduce uncertainties in delay compensation services. The elimination of uncertainty may be another bridge to improve consumers' perception of service value.

Doubts regarding technical information can have adverse effects on consumer trust [45], particularly when they are not sure whether the compensation service would actually bring benefits from them or if it is just a sales approach that encourages them to order again on those platforms. From the importance of service design, a good service design can substantially minimize doubt and ambiguity, improve client confidence, and increase consumers' willingness to order. By optimizing the service plan, the usability and reliability of the service can significantly improve, and the likelihood that consumers order the service can increase. Therefore, we believe that a good delay compensation service can increase



consumers' willingness to order and pay for the service through the bridge of increasing trust and reducing worry.

To sum up, it can be seen from previous studies that different scholars have analyzed the influencing factors of consumer satisfaction and purchase intention in intra-city distribution from their own perspectives, such as information reliability, ease of use, service factors, efficiency, etc. However, the literature has not explored the influencing factors of the ordering intention of the delay compensation service and analyzed how to improve the price of consumers for the delay compensation service. In practice, customers' behavioral intentions depend on their perceptions of the service quality [46]. So, we believe that by optimizing the delay compensation service scheme, the ease of use and reliability of the delay compensation service itself can be improved, such as a clearer display of compensation amount and more detailed presentation of compensation probability, so that consumers can better understand and are more inclined to order the service. At the same time, a better delay compensation service can also increase the potential perceived value of the order. Therefore, we think compared with the general scheme and other schemes, the optimal scheme of delay compensation service of intra-city delivery can increase consumers' ordering willingness. We propose the following hypotheses in this paper:

**Hypothesis 1.** *The optimal delay compensation service scheme can significantly increase consumers' ordering and payment price for delay compensation service.*

This optimal structure contains the optimal level of five attributes, namely delay probability display, compensation amount, compensation method, penalty method, and one-time order price. The five attributes will be discussed in detail in the next section. Considering that consumers with different socio-demographics will have different perceptions of attributes [47,48], especially factors such as age, gender, income level, and education background, this paper also takes demographic characteristics as a factor affecting the deferred compensation scheme and puts forward the following hypotheses:

**Hypothesis 2.** *Consumers' socio-demographic and attribute level will have an interactive effect on consumers' ordering and payment price for delay compensation service.*

To explore more deeply how the delay compensation service plan affects consumers' willingness to order (Hypotheses 1 and 2), we evaluated five attributes and 14 levels of consumer preference schemes using choice experiment analysis. This study investigates how an optimized plan can affect consumers' willingness to order, particularly the interaction between different consumer demographics and service plans.

### 3. Methodology

According to the consumer theory proposed by Lancaster [49], the utility of consumers comes from various attributes of a commodity, rather than the commodity itself. In other words, in the delay compensation service, consumers' value perception does not come from the compensation service but from the different attributes of the compensation service. Therefore, this paper needs to use a micro-approach of consumer research to obtain and analyze the differences in consumers' perceived value for different attributes of compensation services. We chose the choice experiment method to analyze consumers' perceived value of attributes.

In recent years, choice experiments have been used in various fields, mostly in research on consumers' preferences of various attributes [50,51]. This is because choice experiments can effectively reduce research errors by selecting combinations of different attributes and more accurately reflect consumer preference and willingness to pay for different attributes [52]. Several studies have focused on the attitudes or preferences of consumers for the compensation services of delivery serving [25,26]. However, there is no research that combines this area with the choice experiment to study the value perception of consumers for the attribute of compensation service. Therefore, in the current study, we adopted a

choice experiment approach to detect consumer preferences for compensation services in intra-city delivery at the attribute level, and choice experiment can further measure the marginal willingness to pay for the compensation services. In the following sections, we will introduce three aspects in detail: attribute selection of delay compensation service, sample collection required for experiment, and model selection.

### 3.1. Attribute Selection

In choice experiment, the selection of commodity attributes determines the effectiveness and the accuracy of the results [53]. Too many attributes may cause information overload, affecting consumers' perception and judgment of attributes, while too few may lead to missing or insufficient variables, resulting in estimation bias [52]. Whether the selected attribute is reasonable depends mainly on the policy meaning of the attribute or its importance to consumer preferences. In this study, five attributes in delay compensation service were analyzed: delay probability display, compensation amount, compensation method, penalty method for riders, and one-time order price. Since study on the compensation service in intra-city delivery is still in its infancy, except for delay probability display, we selected other attributes in this study according to the real compensation service in the real delivery markets.

While delay probability display is widely used in traffic navigation, this parameter is not common in intra-city delivery services. Through personal communications with a department manager of an intra-city delivery company, we learned that the current delay probability for intra-city delivery in the market is generally less than 1%. For this study, we designed three levels for the delay probability display attribute: (1) none, (2) 99% arriving on time, and (3) 1% delay. The first level is none, because in practice, many merchants do not present the delay probability of order service; it is also used as a benchmark group to compare whether consumers' ordering intention will change when the probability of delay is presented. In addition, we consider framing effect [54], that is, people's views of gains and losses are based entirely on their perceived reference points, and they make decisions differently depending on the reference points. So even though the 99% on-time rate and 1% delay rate are the same, consumers will have different reference points and further form different ordering intentions.

For the compensation value, there are two main forms in the realistic market: fixed amount and progressive amount (the amount increases as the delay time increases). The dynamically increasing value estimation usually has a maximum limit. In this study, two levels for the compensation amount parameter were used: (1) fixed amount and (2) progressive amount (up to 70% of the product). We hope to improve consumers' perception of compensation value without changing the cost of compensation by finding out the forms of compensation value that consumers prefer more. For the compensation method parameter, the two common types of compensation were used as the attribute levels: (1) cash refund and (2) gift vouchers. Since different in-city delivery service providers in China have adopted different forms of compensation, we hope to explore the influence of these two forms of compensation on consumers' ordering intention through scientific methods so as to change the compensation forms of service providers in a directional way. For the penalty-method parameter, three levels were used based on existing plans and a review of related studies. These are (1) no penalty, (2) the rider bears the compensation, and (3) the rider's credit score is penalized. This point is based on a large number of order complaints to explore whether consumers will be willing to punish the deliverers who cause delivery delays, so as to better enable the service providers to manage the relationship between consumers and deliverers and even reduce consumer complaints by punishing the delayed deliverers. For the fifth attribute, the current average price for delay compensation service is about 0.3 yuan/time. In this study, we used four attribute levels, raising the base price by 100%, 200%, and 300%. The attribute levels for the one-time order price parameter are: (1) 0.3, (2) 0.6, (3) 0.9, and (4) 1.2. Table 1 provides a summary detailing the attributes and attribute levels used in this study.

**Table 1.** Attributes and levels of compensation services.

Attribute	Number of Attribute Levels	Levels
Delay Probability Display	3	None 99% Arrive On-Time 1% Delay
Compensation Amount	2	Fixed Amount Progressive Amount (Up to 70% of The Product)
Compensation Method	2	Cash Vouchers
Penalty Method for Riders	3	None Penalty Rider Bears Compensation Reduce Rider's Credit Score
One-Time Order Price	4	0.3 0.6 0.9 1.2

Given the number of attributes and attribute levels, we generated  $3 \times 2 \times 2 \times 3 \times 4 = 144$  full-factor choice sets. However, considering the consumers' information-carrying capacity and logistical considerations for the research, investigating all 144 choice sets would be extremely difficult. Therefore, we adopted the D-optimal partial factorial design to reduce the asymptotic standard error between attributes while maintaining the method's effectiveness (D-efficiency) [55]. Thirty-six choice sets were generated through Negen1.0, with a D-efficiency of 93.80% and D-error of 0.09, which met the research needs. Each choice set contained two generated scenarios (Scenario 1 and Scenario 2) and a third option where no delay compensation service is selected (see Table 2). Finally, the 36 choice sets were divided into six questionnaires. Each questionnaire contained two parts: basic consumer demographics and six random choice sets.

**Table 2.** A sample of choice sets.

	Scenario 1	Scenario 2	Scenario 3
Delay Possibility Display	1% Delay	99% Arrive On-Time	
Compensation Amount	Fix Amount	Progressive Amount (Up to 70% of the Product)	
Compensation Method	Cash	Vouchers	None
Penalty Method for Riders	None	Rider Bears Compensation	
One-Time Order Price	0.9 Yuan/Time	1.2 Yuan/Time	
What is your choice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### 3.2. Data Collection

Research [56] shows no statistical difference between online questionnaires and face-to-face interviews. Therefore, online questionnaires were used for convenience and efficiency. The six questionnaires were distributed evenly through the Credamo platform between 5 and 10 October 2020. Credamo focuses on providing an information-based service platform for scientific research institutions to collect large-scale survey data, and Credamo has been used as a source of data acquisition for a number of authoritative journal articles [57,58]. We mainly gathered a wide range of sample groups through the Credamo platform, put them into different groups according to the idea of random grouping, and finally answered relevant contents according to the process of experimental design to form sample data. A



filter question was set to target respondents who had previously used delay compensation services. Finally, 457 questionnaires were collected, and using screening questions to filter the respondents, 420 were considered valid. The questionnaire response rate reached 91.9%.

The respondents' demographic profile is summarized in Table 3. Among the 420 interviewees, 54.52% were female, and most were below 35 years old. The 25–34 age group comprised the vast majority of respondents, and only one was over 55 years old. The age distribution of the respondents in the survey is in line with the frequency and proficiency of mobile phone users on the national scale. It is also in line with China's in-city delivery service subscription main body being young people. In terms of educational background, 404 interviewees had an associate degree or higher (96.19%). For income levels, those with monthly incomes of "4000–5999 yuan", "6000–7999 yuan", and "8000–9999 yuan", which accounted for 29.52%, 22.38%, and 20.00% of the respondent population, respectively. In terms of frequency of use, the average amount the respondents use intra-city delivery services was 3.38.

**Table 3.** Socio-demographics and economic characteristics of samples.

	Variables	Frequency (N = 420)	Percentage
Gender	Male	191	45.48%
	Female	229	54.52%
Age	≤24	56	13.33%
	25–34	317	75.48%
	35–44	38	9.05%
	45–54	8	1.90%
	55–64	1	0.24%
	≥65	0	0
Education Level	High School and Below	16	3.81%
	Associate or Bachelor Degree	383	91.19%
	Master Degree and Above	21	5.00%
Monthly Income	<2000 Yuan	18	4.29%
	2000–3999 Yuan	39	9.29%
	4000–5999 Yuan	94	22.38%
	6000–7999 Yuan	124	29.52%
	8000–9999 Yuan	84	20.00%
	10,000–14,999 Yuan	52	12.38%
	≥15,000 Yuan	9	2.14%

### 3.3. Model Selection

According to the consumer theory [49], the utility function of consumer  $n$  from compensation scenario  $I$  can be expressed as:

$$U_{ni} = V_{ni}(\beta_n) + \varepsilon_{ni} = \delta(\text{ASC}) + \alpha_n(X_i) + \gamma_n(-P_i) + \varepsilon_{ni} \tag{1}$$

where  $U_{ni}$  is the indirect utility of scenario  $I$ ;  $V_{ni}$  is the observable utility of the scenario;  $\varepsilon_{ni}$  is the random error term, which is the unobservable utility;  $X_i$  is the attribute of scenario  $I$ ; and  $P_i$  is the price of scenario  $I$ . ASC is Alternative Specific Constant, such that when the consumer chooses neither scenario 1 nor 2, ASC is assigned a value of 1; if the consumer chooses either option 1 or 2, the ASC value is 0.  $\beta_n = (\delta, \alpha_n, \gamma_n)$  is the coefficient of each variable, reflecting the weight of consumers on the utility of scenario 3, attributes, and price attributes.  $f(\varepsilon_{ni})$  is the distribution hypothesis for  $\varepsilon_{ni}$ . When  $f(\varepsilon_{ni})$  obeys the

Gumbel distribution, the probability that consumer  $n$  chooses scenario I in scenario J can be expressed as:

$$P_{ni} = \text{Prob}(V_{ni} + \varepsilon_{ni} > V_{nj} + \varepsilon_{nj}, \forall j \neq i) = \frac{e^{V_{ni}(\beta_n)}}{\sum e^{V_{nj}(\beta_n)}} = \int \left( \frac{e^{V_{ni}(\beta)}}{\sum e^{V_{nj}(\beta)}} \right) f(\beta) d(\beta) \tag{2}$$

where  $\beta$  is the parameter vector;  $f(\beta | \theta)$  is the probability density function of  $\beta$ ; and  $\theta$  is the parameter describing the distribution.

$$\text{WTP}_n = - \frac{\beta_{nx}}{\beta_{np}} \tag{3}$$

The willingness to pay (WTP) by consumer  $n$  for attribute X is expressed in Equation (3). WTP is the ratio of different attributes and prices to the marginal utility for consumer  $n$ .

#### 4. Experiment Results

##### 4.1. Main Effects Model Estimation Results

We tested and compared the Multinomial Logit (MNL) and Random Parameter Logit (RPL) models. Based on the principle of Log Likelihood maximization and Akaike Information Criterion (AIC)/Bayesian Information Criterion (BIC) minimization, we compared the values of the two models. The multinomial logit model and random parameter logit model have good fitting results, but the MNL model had a higher log-likelihood value and smaller AIC and BIC. This suggests that the MNL model is more suitable for this study; thus, it is used in the analysis and discussion for the rest of this article. Table 4 shows the estimation results for the MNL model using Stata15.0.

**Table 4.** Results of the Multinomial Logit MNL model.

Variables	Mean Coefficient of Main Effect Model (Standard Deviation Coefficient)	Mean Coefficient of Interaction Effect Model (Standard Deviation Coefficient)
Price	-0.655 *** (-7.32)	-0.671 *** (-7.38)
Delay Possibility Display (Benchmark: None)		
99% Arrive On-Time	0.320 *** (-5.06)	1.485 *** (-2.74)
1% Delay	0.089 (-1.42)	0.657 (-1.19)
Compensation Amount (Benchmark: Fixed Amount)		
Progressive Amount	0.262 *** (-5.83)	-0.712 * (-1.77)
Compensation Method (Benchmark: Cash)		
Vouchers	-0.571 *** (-12.76)	-0.822 ** (-2.04)
Penalty Method for Riders (Benchmark: None)		
Rider Bears Compensation	-0.129 ** (-2.07)	1.027 * (-1.82)
Reduce Rider’s Credit Score	-0.046 (-0.74)	0.19 (-0.34)

Table 4. Cont.

Variables	Mean Coefficient of Main Effect Model (Standard Deviation Coefficient)	Mean Coefficient of Interaction Effect Model (Standard Deviation Coefficient)
ASC	−2.183 *** (−19.12)	−2.879 *** (−3.68)
Income × 99% Arrive On-Time		−0.032 (−0.64)
Income × 1% Delay		0.037 (−0.73)
Income × Progressive Amount		0.001 (−0.03)
Income × Vouchers		−0.005 (−0.13)
Income × Rider Bears Compensation		−0.04 (−0.81)
Income × Reduce Rider's Credit Score		−0.033 (−0.65)
Income × ASC		−0.091 (−1.22)
Gender × 99% Arrive On-Time		−0.282 ** (−2.24)
Gender × 1% Delay		0.029 (−0.23)
Gender × Progressive Amount		0.12 (−1.31)
Gender × Vouchers		0.012 (−0.13)
Gender × Rider Bears Compensation		−0.023 (−0.18)
Gender × Reduce Rider's Credit Score		−0.07 (−0.55)
Gender × ASC		0.012 −0.07
Education Level × 99% Arrive On-time		−0.154 (−0.71)
Education Level × 1% Delay		−0.312 (−1.37)
Education Level × Progressive Amount		0.410** (−2.5)
Education Level × Vouchers		−0.004 (−0.02)
Education Level × Rider Bears Compensation		−0.449 * (−1.93)
Education Level × Reduce Rider's Credit Score		−0.069 (−0.31)
Education Level × ASC		1.017 *** (−3.13)
Age × 99% Arrive On-Time		−0.243 ** (−2.09)

Table 4. Cont.

Variables	Mean Coefficient of Main Effect Model (Standard Deviation Coefficient)	Mean Coefficient of Interaction Effect Model (Standard Deviation Coefficient)
Age × 1% Delay		−0.112 (−0.96)
Age × Progressive Amount		−0.049 (−0.57)
Age × Vouchers		0.019 (−0.22)
Age × Rider Bears Compensation		−0.025 (−0.22)
Age × Reduce Rider’s Credit Score		0.085 (−0.74)
Age × ASC		−0.674 *** (−3.52)
Use Frequency × 99% Arrive On-Time		0.059 (−1.63)
Use Frequency × 1% Delay		0.026 (−0.7)
Use Frequency × Progressive Amount		0.019 (−0.73)
Use Frequency × Vouchers		0.062 ** (−2.36)
Use Frequency × Rider Bears Compensation		−0.003 (−0.07)
Use Frequency × Reduce Rider’s Credit Score		−0.011 (−0.30)
Use Frequency × ASC		0.072 (−1.33)
Observations	7560	7560
Log likelihood	−2172.9518	−2131.7824
Prob > chi2	0.0000	0.0000

Note: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

The MNL results show that most variables are significantly correlated at the  $p < 0.001$  level. This indicates that the variables selected in this study are statistically significant, which means the chosen attributes significantly affect user preferences for delay compensation services. For the attribute “Delay Probability Display”, the mean coefficient for “99% Arrived On-Time” is positive and significant at the 1% level, indicating that consumers are more inclined to show on-time arrival than showing the delay probability or nothing. The delay possibility display is not significant, indicating that consumers have no clear preference regarding this attribute. For the “Compensation Amount” parameter, the option “Progressive Amount” is significant at the 1% level, which suggests that consumers prefer the dynamic compensation scheme and that this method increases the utility for the consumers. In terms of compensation methods, the coefficient for the option “Voucher” is negative and significant, indicating that the consumers prefer a cash compensation scheme. For the penalty method, the option “Rider Bears Compensation” has a negative coefficient and is significant at the 5% level, which means that consumers are against this approach. The consumers have no clear preference for lowering the rider’s ratings, which is not directly linked to income or performance. ASC is significant at the 1% level, and the

negative coefficient indicates that consumers prefer the given design plan compared to the original state. The results suggest that when the platform wants to promote delay compensation services, displaying the probability of on-time arrival, increasing compensation amount as delay time increases, and paying cash compensation can significantly increase the consumers' utility. Therefore, the results verified Hypothesis 1.

#### 4.2. Interaction Effect Model Estimation

Aside from product attributes, the personal characteristics of consumers can also have an impact on the choice of plans [59]. In this study, we examined the interaction between user demographics and the various service attributes. The analysis shows that in the interaction between gender and attributes, women have a negative preference for "99% Arrive On-Time", while men prefer having the on-time arrival possibility display. Education level has a positive interaction significant at the 5% level with "Progressive Amount", while education level and "Rider Bears Compensation" have a negative interaction significant at the 10% level. This means that people with higher education levels prefer "Progressive Amount" and oppose the scheme where the riders would bear the cost. Age has a negative interaction that is significant at the 5% level, with "99% Arrive On-Time", indicating that younger users prefer the on-time arrival possibility display. The interaction between use frequency and compensation methods indicates that the more frequently consumers use intra-city delivery, the more they prefer getting vouchers as compensation. Therefore, the results verified Hypothesis 2.

#### 4.3. Marginal Willingness to Pay

The WTP estimation results are summarized in Table 5. The results suggest that consumers have a positive preference for the "99% Arrive On-Time" display and a progressive compensation scheme. Consumers are willing to pay about 0.49 and 0.40 yuan more for these attributes, exceeding the average market price of 0.30 yuan. Compared with cash compensation, respondents had a negative preference for vouchers, giving a lower WTP of 0.87 yuan. Similarly, the option "Riders Bear Compensation" was found to attenuate consumer utility, with a lower WTP of 0.20 yuan. If platforms adopt attributes with positive consumer utility, people would be willing to pay more for the service, while attributes with negative consumer preferences would require platforms to subsidize some costs for people to accept.

**Table 5.** Estimation of willingness to pay.

Attributes	Marginal Willingness to Pay	Average (Yuan)	Confidence Interval [5%, 95%]
Delay Possibility Display (Benchmark: None)	99% Arrive On-Time	0.49	[0.24, 0.74]
	1% Delay	0.13	[−0.06, 0.33]
Compensation Amount (Benchmark: Fixed Amount)	Progressive Amount	0.40	[0.23, 0.56]
Compensation Method (Benchmark: Cash)	Vouchers	−0.87	[−1.14, −0.61]
Penalty Method for Riders (Benchmark: None)	Rider Bears Compensation	−0.20	[−0.20, −0.40]
	Reduce Rider's Credit Score	−0.06	[−0.25, 0.12]

The results show that consumers have various preferences for attributes in the compensation service. Platforms should set up plans that adopt attributes with positive consumer preference in order to enhance their utility and increase the users' willingness to pay.

## 5. Discussion

This paper expands the ideas of research on information reliability, usability, convenience [36], service factors [37], food factor, price factor, and service factor [28], and efficiency [38] in intra-city delivery. The service innovation of intra-city delivery focuses



on the attribute of delayed compensation service. This study quantitatively analyzed consumer perception on delay compensation services in intra-city delivery using a CE, and many significant main effects and interaction effects are obtained. This proves that CE is suitable to analyze consumers' preferences for delay compensation service for intra-city delivery [11]. At the same time, this is the first study of different attributes of delay compensation service through CE.

Most variables were found to be significantly correlated, which means that these variables are significant determinants of consumer preference and user experience. This indicates that these significant variables all constitute the combinations of various service attributes that were analyzed, namely "Delay Possibility Display", "Compensation Amount", "Compensation Method", "Penalty Method for Riders", and "One-Time Order Price". The experience value of consumers in intra-city delivery service [16,18] is also an extension of the research on service solutions in intra-city delivery research [19,20].

There is no research on the optimization of logistics compensation service in the past [25]. In particular, the role of the main attribute of the deferred service is unclear [28]. In this paper, the respondents were found to prefer having the on-time arrival possibility display and a progressive compensation valuation scheme. In contrast, the respondents opposed using vouchers as the compensation method and requiring the riders to bear the compensation costs. The ASC was significant at the 1% level, and the negative coefficient indicates that the respondents prefer the provided design to the status quo. These detailed findings confirm previous research that deferred compensation services are a type of active compensation that creates more positive emotions and higher engagement [33]. Although this study did not measure user engagement and positive emotions, a higher pay premium seems to positively imply a higher perceived value for consumers [41].

The interactions between service attributes and respondents' demographics were also explored. Men and younger respondents were found to prefer more the on-time arrival possibility display. Respondents with higher education levels prefer progressive compensation amount and oppose the penalty scheme where the riders would bear compensation. In addition, the more frequent the consumers use intra-city delivery, the more they prefer vouchers for compensation. This interactive analysis of demographic characteristics and attributes reveals two important implications. On the one hand, it reflects the different sensitivities and preferences of different consumers to the attributes of delayed compensation services [32], and on the other hand, it also explains the underlying reasons why 40% to 60% of users are dissatisfied with the compensation services [34]. The potential reason for this may be that some attributes that consumers care about are not presented in the compensation scheme. For example, users with high education background are more likely to be dissatisfied with the scheme that penalizes riders. At the same time, we should also be clear that the delay compensation scheme as a way to improve the customer experience [6] needs to take into account the different characteristics of consumers; otherwise, it will be counterproductive.

We also analyzed the influence of different attribute preferences on consumers' marginal willingness to pay. Consumers have a positive preference for "99% Arrive On-Time" and dynamic compensation amount. The results suggest that the respondents were willing to pay 0.49 and 0.40 yuan more for these attributes, respectively. These values are 63% and 33% higher than the average market price for the compensation service valued at 0.3 yuan. These two attribute levels are statistically significant. The respondents had a negative WTP for voucher compensation and "Rider Bears Compensation" attribute levels. This means that these two attribute levels would discount the consumers' value of the whole delay compensation service. If platforms adopt vouchers as the compensation system, an additional cost of about 0.30 yuan would be required to achieve the same effect as having cash reimbursement. This additional cost is higher than the current average price for the compensation service and would therefore not be an efficient and economical option for the platforms. The WTP exploration of compensation service verifies the paradox of service recovery [31]; that is, if some compensation is given for service failure, consumers

will often have a better service experience. This higher service experience is reflected in consumers' willingness to pay more of their budget for compensation services. Therefore, the significance of compensation services is not only to reduce the negative impact caused by service failures [2] in order to maintain consumer loyalty and trust, but also to improve consumers' positive evaluation of services, thus increasing their payment premium [40].

### 5.1. Theoretical Contribution

This study has two important theoretical contributions. The first theoretical contribution is that this paper is the first study of different attributes of delay compensation service through CE. To be specific, we expand the research perspectives of logistics services, especially extending the optimization of service experience to the micro level of consumer perception. Previous research studies on consumers' perception of logistics services mostly focus on service characteristics [28,37], consumers' perception of services (e.g., consumers' perceived control) [60], consumers' motivations for logistics services (e.g., time and cost savings) [61], or societal pressures (e.g., subjective norm) [52]. However, this paper focuses on a more micro level—the perception difference of specific attributes of service solutions. We not only obtain the influence of different attributes on consumers' willingness to subscribe to compensation services and WTP but also analyze the interaction between different attributes and consumer characteristics. This is a study of intra-city distribution service innovation, which extends the traditional perspective of service innovation to the micro domain of consumer perception and obtains macro service innovation ideas through the micro attribute analysis, so as to improve the loyalty and value perception of consumers in the platform. This also provides a research idea about consumer perception for researchers of subsequent delivery services.

The second contribution is that we study the delay compensation scheme in intra-city distribution by using the standard CE method, which is less used in the light logistics in the past. To be specific, the CE method provides a new tool for subsequent scholars to study logistics service optimization, and this paper can be an important reference for the application of this method. In previous studies on consumer perception in articles on logistics distribution, most of them used the structural equation model to analyze the formation of consumer perception [22], or secondary data were used to obtain consumers' purchase information of distribution services, and quantitative methods were used to analyze the correlation between factors [28,36,37]. Meanwhile, CE was rarely used as a research method to explore the specific values of consumers' purchase intention and willingness to pay in the area of logistics distribution [11,53]. Therefore, in previous studies, it is not possible to observe what causes consumers' dissatisfaction with distribution services and the loss of orders in a detailed and microscopic way. The experimental method represented by CE can better observe the reasons behind consumers' purchase factors [62]. Therefore, in the follow-up research, multiple micro and meso methods can be combined to study the topic of distribution service innovation. This paper is an example of micro research on distribution service innovation.

### 5.2. Practical Implication

The results and analyses show that consumers have different preferences for the attributes of delay compensation services in intra-city delivery. Consumer preference affects the willingness to pay and has significant long-term effects on the delivery service providers. Platforms can modify and improve their delay compensation service plans based on the results. The following are some specific management recommendations:

First, the logistics service platform can design a reasonable delay compensation scheme according to the conclusion of this paper. To be specific, in order to effectively promote delay compensation services as an additional insurance measure, intra-city distribution platforms should modify and develop corresponding plans that adapt service attributes that consumers prefer and are willing to spend on. Platforms that have not yet launched delay compensation services (e.g., UU Paotui, Shansong) may want to consider adopting an

arrive on-time display, progressive compensation amount, and cash compensation, which have been shown in this study to increase the consumers' utility. For platforms that have already launched delay compensation services (e.g., Fengniao, Xindada, and Meituan), their service plans should be adjusted appropriately. For example, none of these three platforms have utilized the function of displaying the probability of on-time arrival. In this study, we found that respondents were willing to pay 63% more if provided by this service. The change in some of these attributes of plans require only minimal costs, but they can obtain higher return profits and benefit from positive word-of-mouth marketing.

Second, the logistics service platform can analyze consumer profiles to achieve precision marketing. In exploring the interactions between attributes and consumers' demographics, we found that for different consumers, the attribute preferences vary. This requires that platforms use big data analysis to build consumer profiles to analyze which delay compensation service plans and attributes are more preferred and increase the consumers' willingness to pay. For example, platforms may consider using vouchers to compensate high-frequency users while providing cash refunds to low- and medium-frequency users. By building consumer demographic databases and analyzing user preferences, platforms can more effectively cater to consumer needs and demands and increase service patronage.

Third, the logistics service platform needs to show more responsibility and tolerance for couriers who cause delayed deliveries. Our results show that penalizing riders by requiring them to bear the costs has a significant negative effect. We found that platforms would need to subsidize 0.20 yuan to cover the negative effect of this scheme. People with higher educational levels are even more averse to this method. This may be because as people get more educated, they become more aware and sympathetic to the challenges of delivery personnel. Delivery service providers are strongly advised that in order to show their corporate responsibility and not cause public backlash, they should keep away from this policy altogether. In this way, people will not be turned off from acquiring the service due to the possibility that the riders would be financially penalized for the delay, and eventually, their recognition and royalty to the platforms could be developed gradually.

### 5.3. Limitations and Future Research Directions

This article analyzed various attributes of delay compensation service in intra-city delivery and explored the consumers' preferred service design. However, there are several limitations of this study that can be explored in future research.

First, there are some factors affecting compensation services that have not been explored and analyzed. So, other attributes of intra-city delivery can be further investigated. For example, default options may affect consumers' choices of products [63]. Platforms can set compensation service as a default option, and if consumers do not need it, they can cancel. An advantage of default options is that it can reduce consumers' negligence and non-selection caused by inertia. Some other contextual attributes can also be explored. For example, order time (i.e., peak time vs. downtime) may affect consumers' preferences for various compensation service attributes. During peak periods, consumers may increase their preference for certain attributes and would be willing to pay more for them.

Second, other characteristics of consumers are worth exploring, and future research can also explore how other consumer characteristics affect attributes preferences. For example, consumers' trust in service platforms [41] and consumers' risk perception [44] may significantly affect consumer preference. Using proper user profiling or questionnaire surveys, platforms would be able to better understand the needs and wants of their consumers or even provide specialized services to a particular segment of their consumer base.

Finally, the causality between attributes and betrothal order needs further verification. In future research, online field experiments can be used to discuss the relationship between attributes and various concepts such as willingness to order, trust, and perceived value. Random grouping can be used to test whether certain service plans can better stimulate

consumers' willingness to order and increase trust in the platforms. These studies can provide platforms a higher level of competitiveness for their service innovations.

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