

Post-COVID-19 Syndrome: The Effect of Regret on Travelers' Dynamic Carpooling Decisions

Li Wang, Boya Wang*, and Qiang Xiao

Abstract

Coronavirus disease 2019 (COVID-19) has severely curtailed travelers' willingness to carpool and complicated the psychological processing system of travelers' carpooling decisions. In the post-COVID-19 era, a two-stage decision model under dynamic decision scenarios is constructed by tracking the psychological states of subjects in the face of multi-scenario carpooling decisions. Through a scenario experiment method, this paper investigates how three psychological variables, travelers' psychological distance to COVID-19, anticipated regret, and experienced regret about carpooling decisions, affect their willingness to carpool and re-carpool. The results show that in the initial carpooling decision, travelers' perception gap of anticipated regret positively predicts carpooling willingness and partially mediates between psychological distance to COVID-19 and carpooling willingness; in the re-carpooling decision, travelers' perception gap of anticipated regret mediates in the process of experienced regret influencing re-carpooling willingness; the inhibitory effect of experienced regret on carpooling in the context of COVID-19 is stronger than its facilitative effect on carpooling willingness. This paper tries to offer a fact-based decision-processing system for travelers.

Keywords

Carpooling Psychology, COVID-19 Pandemic, Psychological Distance

1. Introduction

Driven by the rapid proliferation of information and communication technology, the sharing economy has become an emerging trend that enables sharing to grow and empower transactions, which is growing exponentially worldwide and is also expected to grow significantly in the coming years [1,2]. The ongoing progress of digitalization supports the provision of real-time information and offers easy accesses for sharing of resources, leading to a societal change of consumer behavior towards collaborative consumption or shared economy in various areas [3]. Represented by carpooling and bike sharing, sharing travel has attracted wide attention in recent years, which offers numerous benefits for our society. Carpooling, a travel mode under the sharing transportation economy, not only makes rational use of idle capacity resources of road vehicles but also can effectively reduce private car travel and pollutant emissions, alleviate urban traffic pressure and reduce travel costs [4]. Carpooling is an informal form of commuter ride-sharing that can mitigate traffic congestion and parking demand [5]. In the long term, carpooling is an effective path to reduce traffic pollution and promote sustainability.

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* Corresponding Author: Boya Wang (anyaboya@163.com)

Dept. School of Economics and Management, Lanzhou Jiaotong University, Lanzhou, China (wangli81@mail.lzjtu.cn, anyaboya@163.com, lzjt_xq@126.com)

Therefore, carpooling has been encouraged by the government due to its benefits to green and low-carbon travel. Nevertheless, with the global outbreak of the novel coronavirus (COVID-19), especially since the World Health Organization declared the novel coronavirus outbreak a public health emergency of international concern on January 30, 2020, the sharing economy had suffered an unprecedented impact. Although prevention measures have been put in place on carpooling platforms such as Uber and Didi, both providers and customers of the sharing economy still have increased hygiene concerns [6]. Due to the lockdown and other policies, individuals' travel mode has changed a lot, let alone carpooling, which may cause travelers' concerns about COVID-19 infection when sharing a ride with others. With the efforts of countries all over the world for two years, the pandemic prevention policies are gradually improved, vaccines are successfully developed, and vaccination rates are gradually increasing. However we still suffer many inconveniences due to the pandemic. In post-COVID-19 era, will travelers be able to accept carpooling again? How will travelers' psychological state of carpooling adjust? These are the questions we need to consider and respond to. Notwithstanding that some studies have focused on the researches of sharing travel from a psychological perspective, for example, Bachmann et al. [7] explain carpooling intention from the perspectives of carpooling passengers and drivers based on the theory of planned behavior, the norm activation model and dispositional trust. In the new “post-COVID-19” scenario, the psychological state and information process of travelers when facing carpooling decisions are more complex and changing. The carpooling decision of travelers is a process of information-processing process, which may be affected by both external environmental factors and internal psychological factors. Thus, this study focuses on the psychological information processing mechanisms of travelers' carpooling decisions in the post-COVID-19 era. Based on regret theory, we construct a two-stage model of carpooling willingness based on the interaction between psychological distance (PD), anticipated regret (AR), and experienced regret (ER) in a dynamic decision-making scenario. This study tries to provide related studies that use other methodologies with some survey-based information processing systems of travelers, and also guidance and reference for the management and regulation of carpooling in the context of recurrent global pandemics.

2. Literature Review and Research Hypotheses

According to the affect-as-information model, emotions act as information in the individual's decision-making process and can provide information related to one's current available tendencies and cognitions, based on which people make “colored” judgments that influence their subsequent attitudes and behaviors [8,9]. Regret is a more or less painful cognitive or emotional state of feeling sorry for misfortunes, limitations, losses, transgressions, shortcomings, or mistakes [10], and is a negative affective experience triggered by cognitive comparisons. People experience regret when the foregone outcome would have been better compared with the obtained outcome [11]. Regret theory has been widely accepted as a good descriptive model for understanding behaviors under risk [12]. Among the processes that reduce the pain of regrettable action is a tendency for people to take steps to undo or ameliorate their regrets of action more than their regrets of inaction [13]. There are various ways to classify regret, among which regret can be divided into AR and ER according to the occurrence of regret before or after the decision-making behavior. AR refers to beliefs about whether or not feelings of regret or upset will follow from inaction [14], which occurs before the decision-making behavior. We can anticipate the possible emotional

consequences of our choices before we make them and use these anticipated emotions to guide our choices [15]. ER elicits when individuals have realized that they selected a worse option and helps individuals adjust their strategies and behaviors when similar situations occur in the future [16].

Given the avoidance of decision regret and the spatial and temporal context of the post-pandemic period, this paper proposes that there are two psychological states of “anticipated regret for refusing to carpool (ARRC)” and “anticipated regret for accepting to carpool (ARAC)” in travelers' initial carpooling decision. The former is the traveler's AR of giving up the benefits of carpooling by refusing carpooling, and the latter is the traveler's AR of giving up the benefits of riding alone and increasing the risk of COVID-19 infection by accepting carpooling. We propose that the perception gap between the two ARs (ARRC – ARAC) will ultimately affect the travelers' carpooling willingness. Specifically, when travelers' ARRC is higher than ARAC, their carpooling willingness is stronger; on the contrary, when travelers' ARRC is lower than ARAC, their carpooling willingness is lower. For that reason, we propose:

Hypotheses 1 (H1): Travelers' perception gap of anticipated regret (PGAR) positively affects their carpooling willingness.

PD is an important psychological variable that influences individuals' perceived regret [17], which refers to one's perception of when an event occurs, where it occurs, to whom it occurs, and whether it occurs and influences individuals' thoughts, responses, and behaviors [18]. Based on construal level theory (CLT), individuals use higher-level construals to represent distant future activities rather than near future activities [19]. Individuals tend to use some abstract features to represent distant events and use subordinate terms to describe near-future activities. CLT divides PD into four dimensions: (1) spatial, how distal in space is the target from the perceiver; (2) temporal, how much time separates between the perceiver's present time and the target event; (3) social, how distinct is the social target from the perceiver's self; and (4) hypotheticality, how likely is the target event to happen, or how close it is to reality, as construed by the perceiver [20].

This paper introduces the variable of “psychological distance to COVID-19” (hereinafter referred to as PD), which is defined as the subjective perception of travelers about the distance, the time, and the probability of the occurrence of COVID-19. The three measurement dimensions are “spatial distance,” “temporal distance” and “hypothetical distance”. Based on CLT, the closer the traveler's PD, the more specific the psychological characteristics of the risk of COVID-19 infection due to accepting to carpool, and the stronger ARAC; on the contrary, the more distant the traveler's PD, the more abstract the psychological characteristics of the risk of COVID-19 infection due to accepting to carpool, and the weaker ARAC. According to H1, if the travelers perceive stronger ARAC, PGAR will be smaller, and carpooling willingness will be lower; if the travelers perceive weaker ARAC, PGAR will be larger, and carpooling willingness will be higher. Following that, we propose that:

Hypotheses 2 (H2): Travelers' PGAR about carpooling decisions mediates the process of PD influencing carpooling willingness.

While we have considered the initial carpooling decision scenario above, in fact, the carpooling decision of travelers is a multi-stage and multi-node complex decision-making process, during which travelers' psychological state and feelings of regret vary as a result of the previous carpooling decision. In other words, once the travelers make the initial carpooling decision, whether they reject or accept to carpool, the result of the initial carpooling decision will further cause the travelers' ER for the chosen option, which will affect the subsequent psychological state and carpooling decision. Specifically, when travelers experience “ER of refusing to carpool,” they will deepen their ARRC when facing the decision

of re-carpooling, and PGAR will become larger and their willingness to re-carpool will increase; on the contrary, when travelers experience “ER of accepting to carpool”, they will deepen their ARAC when facing the decision of re-carpooling, and PGAR becomes smaller and their willingness to re-carpool will decrease. Therefore, we assume that:

Hypotheses 3 (H3): Travelers' PGAR about carpooling decisions mediates the process of ER influencing re-carpooling willingness.

Hypotheses 4 (H4): Travelers' ER about carpooling decisions significantly affects the willingness gap between travelers' willingness to carpool in the initial carpooling decision and their willingness to carpool again in the re-carpooling decision.

Based on the above discussion and hypotheses, a two-stage decision model for this study is developed, as shown in Fig. 1.

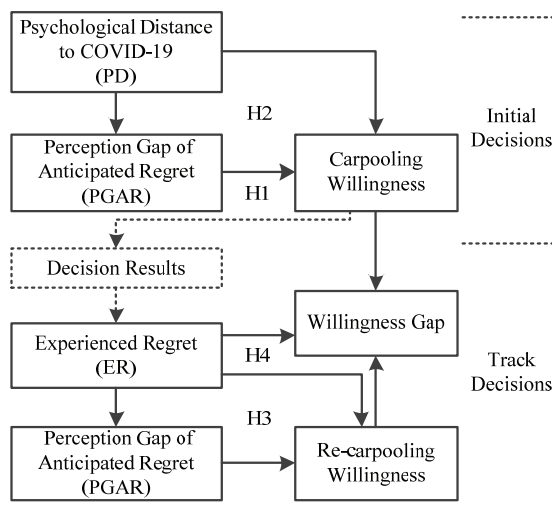


Fig. 1. Model framework.

3. Methodology

Most of the studies on carpooling use computer simulations, offering explanations and suggestions for travel behavior scientifically and effectively, and some of them have added “passenger psychology” into simulation studies, but there remains a lack of research on the psychology of travelers. The experiment method makes it possible for us to explore the psychological state of travelers when making travel decisions, leading many researchers to come to realize the significance of applying an experimental approach to travel studies. Therefore, this study chooses the scenario experiment method to investigate the influence of travelers' psychological state on their carpooling willingness by setting up realistic experimental scenarios and tracking the subjects' psychological state and carpooling willingness in multiple scenarios. The research design is conducted in three stages: the first stage is a semi-structured interview; the second stage is a questionnaire survey; and the third stage is an experimental scenario testing. Data collection began in mid-April 2021, and the whole research investigation took about 8 months.

The first stage of semi-structured interviews aims to obtain the respondents' willingness to accept carpooling and the specific reasons for accepting or refusing it. A total of 187 sample data are collected, and the original interview recordings (with respondents' consent) are coded using the coding method of rooted theory, including 96 pieces of data information on acceptance of carpooling and 91 pieces of data on refusal of carpooling.

In the second stage, the results of the interview coding are inductively refined, and a survey scale of factors influencing carpooling willingness is developed and a small-scale questionnaire survey ($n=121$) is conducted from July 2021 to August 2021. The survey results show that the main reasons for respondents to accept carpooling are: relieving traffic pressure (71.08%), saving energy loss (68.60%), government advocating green travel (60.33%), saving waiting time for rides (57.85%), and saving the cost of rides (38.84%); the main reasons for refusing to carpool include health risk under COVID-19 pandemic (81.82%); the need to share the ride space alone (70.25%), and the reduced comfort of the ride (61.98%).

Based on the results of the first two stages of the study, we find that travelers' ARRC is mainly due to the increased "waiting time" and "cost of travel," and "giving up a green travel option" is also considered as an important psychological factor for ARRC. ARAC mainly arises from "higher risk of infection," "reduced ride comfort," and "exclusivity of ride space." According to the above findings, in the third stage of experimental scenario testing, we first design three scenarios for the initial carpooling decision and the re-carpooling decision and use situational language to describe the scenarios (Table 1). Secondly, we develop a measurement scale to measure the variables of carpooling willingness (W), anticipated regret (AR), experienced regret (ER), and psychological distance to COVID-19 (PD). The variable scales are adapted to the carpooling scenarios, and all questions are scored on a 7-point Likert scale. Among them, the PD scale is borrowed from the studies of Spence et al. [21] ($\alpha=0.745$); AR and ER scales are borrowed from the studies of Abraham and Sheeran [14], and Inman and Zeelenberg [22] ($\alpha_{ER1}=0.877$, $\alpha_{ER2}=0.898$). In addition, in the follow-up empirical test, we add the variable "PGAR," which is defined as the gap between ARRC and ARAC. $PGAR = ARRC - ARAC$. The experimental scenarios and measured variables at each stage are shown in Table 1.

Table 1. Experimental scenarios

Experimental scenario	Scenario description
Initial carpooling scenario	In this scenario, subjects are informed of the advantages of accepting carpooling and rejecting carpooling and then are asked about their willingness to carpool in this scenario (W1) and their AR for this carpooling decision (AR1).
Re-carpooling scenario A	This scenario assumes that the subjects refuse to carpool and then informs them that the waiting time for the ride increases due to their refusal to carpool. The subjects are asked about their ER (ER1) for the initial carpool decision as well as their AR (AR2) for the re-carpool decision and willingness to re-carpool.
Re-carpooling scenario B	This scenario assumes that the subjects refuse to carpool and then informs them that there is a confirmed case of COVID-19 in the subject's city. This carpooling experience with a stranger raises the subject's concern. Then the subjects are asked about ER (ER2) for the initial carpooling decision as well as their AR (AR3) for the re-carpool decision and willingness to re-carpool (W3).

4. Results

4.1 Manipulation Test

Using a paired sample t-test to test the validity of the experimental scenarios, we find that our construction of the three scenarios is successful. The subjects' carpooling willingness is significantly higher in the re-carpooling scenario A than that in the initial carpooling scenario (4.79 vs. 3.93, $p=0.000^{***}$), and the subjects' carpooling willingness is significantly lower in the re-carpooling scenario B than that in the initial carpooling scenario (3.17 vs. 3.93, $p=0.000^{***}$). In re-carpooling scenario A, where we set a psychological experience of longer waiting time for a ride due to refusal of carpooling, the subjects' carpooling willingness is significantly higher than their initial carpooling willingness; in re-carpooling scenario B, where we set a psychological experience of possible increased risk of COVID-19 infection due to acceptance of carpooling, the subjects' carpooling willingness is significantly lower than their initial carpooling willingness.

4.2 Sample Characterization

The formal experimental period of this study is from September 2021 to December 2021, and a total of 309 convenience samples participated in the experimental survey. To recruit subjects from all over China without the limitation of the experiment site and time, we mainly use an online program with the experiment scenarios shown on different pages of the program. The experiment contains several scenario descriptions and requires a long participation time, needing subjects to have certain text comprehension abilities and to put themselves in the scenario to answer. Therefore, according to the participation time and option polarization, we eliminate the results with too short answering time and those with obviously inattentive answers, and obtain 261 valid subjects, with a valid recovery rate of 84.5%. In Table 2, 261 valid subjects include 72 males (27.6%) and 189 females (72.4%); age is mainly concentrated between 18–29 years old; undergraduate and postgraduate education is the majority; students (70.5%) and white-collar (13.4%) subjects occupy a very large percentage of the subjects. The above sample characteristics are consistent with the results of the “2018 China cab and online taxi travel user research report” by

Table 2. Demographic characteristics (n=261)

Variable	Category	Frequency	Percentage (%)
Sex	Male	72	27.6
	Female	189	72.4
Age (yr)	<30	234	89.7
	≥30	27	10.3
Education	Below bachelor degree	32	12.3
	Bachelor	128	49.0
	Above bachelor degree	101	38.7
Occupation	Students	184	70.5
	White-collar	35	13.4
	Government staff	11	4.2
	Others	31	11.9
Income (CNY)	≤2,000	156	59.8
	2001–4000	46	17.6
	4000–6000	32	12.3
	>6000	27	10.3

www.bigdata-research.cn, which shows that 80% of cab and online taxi travel users are aged 18–35, and white-collar workers account for the highest percentage. In addition, due to the high willingness and conscientiousness of female subjects to participate in the experimental survey and answer relatively seriously, the proportion of female subjects in this survey is high. Overall, the sample structure is reasonable and in line with the survey needs.

4.3 Descriptive Statistics

The correlations between the variables are tested using SPSS version 25.0, and the means, standard deviations, and Pearson correlation coefficients are obtained for each variable. The results show that in the initial carpooling scenario, PD is significantly negatively correlated with AR1 ($r=-0.186$, $p<0.01$) and W1 ($r=-0.287$, $p<0.01$), and AR1 is significantly positively correlated with W1 ($r=0.455$, $p<0.01$). The correlations between ER1, AR2 and W2 are all significant and positive at the 0.01 level; in re-carpooling scenario A, ER2 and AR3 ($r=-0.349$, $p<0.01$), ER2 and W3 ($r=-0.238$, $p<0.01$) are significantly negatively correlated, and AR3 is significantly positively correlated with W3 ($r=0.517$, $p<0.01$). Overall, the data structure is generally consistent with the expectations of this study.

4.4 Hypotheses Test

(1) Main effect and mediating effect test in the initial carpooling scenario

This study uses a stepwise regression model, and the results of the main effects regression test are shown in Table 3. Model 1 and model 2 take PGAR as the dependent variable, and models 3, 4, and 5 take carpooling willingness as the dependent variable. Among them, Model 1 and model 3 are the baseline models and incorporate only control variables. Model 4 is the main effect model by adding the independent variable PD to model 3. The test results show that the regression coefficient of PD is -0.261 ($p=0.000^{***}$), indicating that PD has a significant negative inhibitory effect on carpooling willingness.

Table 3. Main effect and mediating effect test in the initial carpooling scenario ($n=261$)

Variable	PGAR		Carpooling willingness		
	Model 1	Model 2	Model 3	Model 4	Model 5
Control variable					
Sex	-0.042	-0.038	-0.089	-0.082	-0.067
Age	0.140	0.120	0.140	0.109	0.059
Education	-0.038	-0.016	-0.140	0.021	0.027
Occupation	-0.023	-0.034	0.031	0.013	0.028
Income	-0.136	-0.123	0.034	0.053	0.105
Independent variable					
PD		-0.170**		-0.261***	-0.189***
Mediating variable					
PGAR					0.420***
R ²	0.031	0.058	0.048	0.113	0.279
F	1.640	2.626*	2.599*	5.382***	13.954***

The standardization factors are reported.

* $p<0.05$, ** $p<0.01$, *** $p<0.001$.

In model 2, the regression coefficient of psychological distance is -0.170 ($p=0.007^{**}$), indicating that PD has a significant negative effect on PGAR. Model 5, which includes both the independent variable

PD and the mediator variable PGAR, shows that the regression coefficient of PD decreases from -0.261 to -0.189 compared to model 4 and the regression coefficient of PGAR is significant at 0.420 ($p=0.000^{***}$). According to the mediating effect test proposed by Baron and Kenny [23], it is clear that PGAR partially mediates the relationship between PD and carpooling willingness. Therefore, H1 and H2 are supported.

The Bootstrap program developed by Hayes is used to test the robustness of the mediation effect, as shown in Table 4. The results of the indirect effect test show that the 95% confidence interval (CI) (-0.194, -0.026) does not contain 0 and the mediation effect is significant with a mediation effect value of -0.108. Meanwhile, the direct effect of PD on carpooling willingness remains significant with a 95% CI (-0.453, -0.121) that does not contain 0, thus indicating that it is partially mediation effect, and H1 and H2 are further tested.

Table 4. Bootstrap test of mediation effect in the initial carpooling scenario (n=261)

	Effect Path	S.E	Effect	Bootstrap 5,000 times 95% CI	
				Lower	Upper
Total effect	All	0.092	-0.395	-0.576	-0.214
Direct effect	PD→Carpooling willingness	0.084	-0.287	-0.453	-0.121
Indirect effect	PD→PGAR→Carpooling willingness	0.044	-0.108	-0.194	-0.026

(2) Main effect and mediating effect test in the re-carpooling scenario

Using a stepwise regression model as well, we find that ER has a significant positive contribution to the re-carpooling willingness ($r=0.682$, $p=0.000^{***}$), and the regression coefficient of ER in model 2 is 0.293 ($p=0.000^{***}$), which indicates that ER has a significant positive effect on PGAR. The results of model 5, which includes both the independent variable ER and the mediating variable PGAR, show that the regression coefficient of PGAR is 0.095, which has a significant effect ($p=0.048^*$). Accordingly, it can be inferred that PGAR plays a partially mediating role between ER and re-carpooling willingness. The Bootstrap program is used to conduct a robustness test for the mediating effect, as shown in Table 5. The results of the indirect effect test show that the 95% CI (-0.012, 0.070) contains 0, and the mediating effect is not significant.

Table 5. Bootstrap test of mediation effect in the re-carpooling scenario A (n=261)

	Effect Path	S.E	Effect	Bootstrap 5,000 times 95% CI	
				Lower	Upper
Total effect	All	0.047	0.712	0.619	0.803
Direct effect	ER→Carpooling willingness	0.049	0.682	0.586	0.778
Indirect effect	ER→PGAR→Carpooling willingness	0.021	0.029	-0.012	0.070

Comparing the results of the two tests, the amount of R2 change in model 5 and model 4 in the stepwise regression results is only 0.008, and the regression coefficient of PGAR on re-carpooling willingness is relatively small ($r=0.095$, $p<0.1$), indicating that the mediating effect is relatively weak. Thus, when we use the Bootstrap procedure for robustness testing, we fail to capture this mediating effect. Therefore, in the spirit of seriousness and caution, this paper decides to discard the results of the stepwise regression model, and H3 fails to receive strong support in the re-carpooling scenario A.

In the re-carpooling scenario B, ER has a significant negative inhibitory effect on re-carpooling willingness ($r=-0.220$, $p<0.001^{***}$) and ER has a significant negative effect on PGAR ($r=-0.353$, $p=0.000^{***}$) in Model 2. Model 5 includes both the independent variable ER and the mediating variable PGAR, and the results show that the mediating effect of PGAR is significant ($r=0.502$, $p=0.000^{***}$) and the effect of ER is no longer significant, therefore, PGAR plays a full mediating role between ER and re-carpooling willingness. H3 is strongly supported in the re-carpooling scenario B and the mediating effect is a fully mediating effect.

Further robustness tests for the mediating effect are conducted using the Bootstrap program, as shown in Table 6. The results of the indirect effect test show that the 95% CI (-0.289, -0.130) does not contain 0, and the mediating effect is significant with a mediating effect value of -0.206. However, the direct effect of ER on the re-carpooling willingness is not significant, and the 95% CI (-0.453, 0.081) contained 0, indicating that the mediating effect is a fully mediating effect, and H3 in re-carpooling scenario B is tested.

Table 6. Bootstrap test of mediation effect in the re-carpooling scenario B (n=261)

	Effect Path	S.E	Effect	Bootstrap 5,000 times 95% CI	
				Lower	Upper
Total effect	All	0.072	-0.257	-0.398	-0.116
Direct effect	ER→Re-carpooling willingness	0.067	-0.051	-0.182	0.081
Indirect effect	ER→PGAR→Re-carpooling willingness	0.040	-0.206	-0.289	-0.130

(3) Cross-scenario effect test of ER

To investigate the role of ER in the travel dynamic decision-making process and explain the effect of ER on the cross-scenario variation of travelers' carpooling willingness, this study uses the gap between the carpooling willingness in the two re-carpooling scenarios and that in the initial carpooling scenario to get a new variable which is called willingness gap. Then this study uses it as the dependent variable and ER under the two re-carpooling scenarios as the independent variables for regression analysis. The results show that, in the re-carpooling scenario A, ER has a significant positive contribution to willingness gap A ($r=0.123$, $p=0.047^*$); in the re-carpooling scenario B, ER has a significant negative inhibitory effect on willingness gap B ($r=-0.227$, $p=0.000^{***}$). The inhibitory effect is stronger in the re-carpooling scenario B than the facilitation effect in the re-carpooling scenario A. H4 is then supported.

5. Conclusion

5.1 Discussions

This study measures the dynamic variations of travelers' psychological state and carpooling willingness in the face of carpooling decision through the scenario experiment method, revealing the important roles of PD and regret in travelers' carpooling decisions. Different from the related researches which use the methodology of computer simulations, we try to offer a fact-based decision-processing system for travelers through a multi-stage decision-making experiment and several surveys. This study reveals the mechanisms of PD, AR, and ER in travelers' dynamic carpooling decisions, and explores the predictive

effects of the above three variables on travelers' carpooling willingness under the context of the COVID-19 pandemic. The results of the empirical analysis indicate that:

(1) Travelers' AR to their carpooling decision significantly and positively affects their carpooling willingness. This finding is consistent with some studies that use random regret minimization models to predict travelers' travel decisions, i.e., travelers are not only seeking to maximize benefits but also avoiding regret when faced with travel decisions. Thus, when travelers' AR is higher for refusing a carpool, their carpooling willingness is higher; conversely, when travelers' AR is higher for accepting a carpool, their carpooling willingness is lower.

(2) Travelers' PD to COVID-19 is an important indicator for predicting travelers' initial carpooling willingness in the post-COVID-19 era. In the context of the COVID-19 pandemic, travelers' AR of accepting carpooling includes a particular representation of the increased risk of COVID-19 infection due to accepting carpooling. Therefore, we introduce PD to COVID-19 in an attempt to explore the role of the relationship between the three variables. The results show that when travelers' PD is closer, they will perceive more specifically the risk of COVID-19 infection due to accepting to carpool, their ARAC will be higher and their carpooling willingness will be lower. In other words, due to the inconsistent perception of PD of travelers to the pandemic, the AR of travelers for the carpooling decision will be different, and therefore the carpooling willingness will be different.

(3) ER is a barometer of multi-stage carpooling tracking decisions. ER is the emotion that individuals feel after deciding because the real outcome is worse than the outcome of the unselected decision. If a carpool is rejected, the traveler's ER is the long wait for the ride; if a carpool is accepted, the ER may arise from the psychological anxiety caused by the pandemic. That is to say, the individual's ER of the decision result not only directly changes the traveler's choice direction when making another decision, but also further strengthens and amplifies the individual's AR when making another decision, which in turn affects the re-carpooling willingness. In our analysis, we find that the mediating effect of ER induced by the pandemic is strong, further demonstrating the necessity of introducing COVID-19 pandemic variables into travel studies.

(4) The COVID-19 pandemic increases the risk of carpooling among travelers and generates a specific regretful experience of carpooling, which in turn acts as an inhibitor to carpooling. By introducing the "willingness gap" variable, we find that ER is a stronger inhibitor of carpooling willingness than a facilitator. This finding suggests that travelers' concerns about the infection risk of the pandemic outweigh the perceived benefits of carpooling and that the COVID-19 pandemic significantly reduces or even destroys people's established and developed carpooling willingness and habits.

In addition, it is particularly crucial to note that in late October 2021, during the official implementation of this study, a new round of the COVID-19 pandemic emerged in China, which affected 21 provinces across the country and caused widespread social concern. Using the point in time when this round of pandemic emerged as the boundary, we divide the sample data into two groups using the point of time of the outbreak of the new round of the COVID-19 pandemic. We find that the mean (average) initial carpooling willingness of the respondents decreased from 4.11 to 3.84 and the mean (average) ER of the respondents in the re-carpooling scenario B increased from 4.85 to 5.10. This actual change of the data is fully in line with the research preconceptions of this study. In the post-COVID-19 era, the uncertainty of the outbreak has caused people's psychological state to constantly adjust to the environment, significantly reducing people's willingness to travel by carpooling. It will be a concern for future research when the sharing travel mode represented by carpooling will recover or what factors will trigger the

recovery.

Combining the above empirical results and research discussions, we propose the following suggestions that may shed light on the revival of carpooling in post-COVID-19 era.

(1) The government should enhance travelers' perceptions of the value of carpooling, especially their sense of participation and contribution to urban transportation and social green development, and thus increase the AR of refusing carpooling and increase the willingness to carpool. Regulate and supervise pandemic prevention and control measures, control the number of carpooling passengers, and create a comfortable, safe, and healthy carpooling environment to reduce the travelers' AR of carpooling and to increase their carpooling willingness.

(2) The government should guide the whole society to form a proper understanding of the COVID-19 pandemic and adjust travelers' prevention psychology. As China adheres to the policy of “dynamic zero” for the pandemic, we achieved rapid prevention and control of the pandemic with high effectiveness, but the mandatory prevention measures have also brought a greater impact on travelers' PD to COVID-19. The current outbreak of the pandemic is characterized by “many points, wide area, and large frequency,” and how to effectively intervene to adjust people's correct perception of the pandemic is a direction that the state and various forces in society should pay attention to.

(3) Improving the timeliness of information disclosure under the government's precise pandemic prevention and disclosing the specific process of the government's pandemic prevention work can effectively reduce individuals' unnecessary psychological worries about the infection, thus paving the way for psychological construction to reshape individuals' carpooling travel in the post COVID-19 era.

5.2 Limitations

There are numerous limitations to the present study. First, this study explores the effects of traveler's regret psychology when making travel decisions to explain the differences in their willingness to carpool. To find out the main resources of travelers' AR, we conduct semi-structured interviews and a small-scale survey before the scenario experiment. However, due to the considerations of questionnaire length and respondents' response time, this study only measures several main dimensions of AR in carpooling decisions and fails to cover other aspects that may also generate travelers' AR, and subsequent studies may consider other aspects of travelers' AR in carpooling decisions. Second, this study investigates the role of travelers' psychological state on their carpooling choice across scenarios by setting a main initial scenario and two sub-scenarios. Although the validity of the scenario setting is supported by statistical data, the decision scenarios faced by travelers in reality may be more complex. Future studies may consider more complex scenarios for experimental research or track the real carpooling data. Third, the subjects in this study are all from China, but there are differences in the pandemic prevention and control policies among countries all over the world, and the psychological state of the travelers may also differ due to cultural differences. Future studies may explore the differences in carpooling willingness caused by such differences.

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Li Wang <https://orcid.org/0000-0003-0049-3741>

She received a B.S. degree from China University of Mining and Technology and an M.S. degree from Northwest Normal University. She is currently an associate professor in the Department of Economics and Management, at Lanzhou Jiaotong University, Gansu, China. Her current research interests include travel behavior and sociology.



Boya Wang <https://orcid.org/0000-0002-2035-0943>

She received a B.S. degree in human resources management from Xi'an University of Technology in 2019. She is currently pursuing her M.S. degree in the School of Economics and Management at Lanzhou Jiaotong University. Her research interests include travel behavior and business management.



Qiang Xiao <https://orcid.org/0000-0002-6696-7041>

He received an M.S. degree in the School of Electronic Information and Electrical Engineering from Lanzhou Jiaotong University in 2007, and a Ph.D. degree in the School of Traffic and Transportation from Lanzhou Jiaotong University in 2017. He is currently a professor in School of Economics and Management, Lanzhou Jiaotong University, Gansu, China. His research interests include data mining and data analysis.