applied sciences

MDPI

Article

Experimental Study on the Risk Preference Characteristics of Members in Supply Chain Emergencies

Yulei Gu [1], Wenqiang Chen [2] and Haiping Liu [3,*]

[1] School of Automobile, Chang'an University, Xi'an 710064, China; gylei001@chd.edu.cn
[2] School of Transportation Engineering, Chang'an University, Xi'an 710064, China; cwqiang007@chd.edu.cn
[3] School of Foreign Studies, Chang'an University, Xi'an 710064, China
* Correspondence: lhpholly@chd.edu.cn

Abstract: Since risk preference affects the behavior of decision makers, the study of its characteristics and impact on decision-making contributes to good planning for emergency coordination. The consistency of a member's risk preferences in the conventional risk field and emergencies of a supply chain was analyzed by applying the prospect theory and adapting the domain-specific risk-taking (DOSPERT) scale. The influence of time pressure on the risk preferences and decision-making behaviors of members was studied in the emergency field and its sub-emergencies of a supply chain. The conclusions were drawn based on the empirical study. First, the risk preference could be measured in terms of conventional risk and emergencies. Second, the members tended to be risk averse with no time pressure, and the degree of risk aversion was weakened with time pressure, which had the greatest effect in the natural disaster event. Third, even though the change in risk preference had a consistency regarding the four types of sub-events of supply chain emergencies, it was inconsistent regarding the conventional risks and emergencies. With the evolution trend of risk preference demonstrated and the relationship between preference and time pressure revealed, this study may provide a decision-making reference for the formulation of a supply chain emergency coordination scheme.

Keywords: risk preference; supply chain; emergency; experimental study; time pressure

check for updates

Citation: Gu, Y.; Chen, W.; Liu, H. Experimental Study on the Risk Preference Characteristics of Members in Supply Chain Emergencies. *Appl. Sci.* **2023**, *13*, 8188. https://doi.org/10.3390/app13148188

Academic Editors: Mirco Peron and Kuo-Ching Ying

Received: 9 May 2023
Revised: 5 July 2023
Accepted: 6 July 2023
Published: 14 July 2023

1. Introduction

A supply chain refers to the network structure formed by upstream and downstream enterprises involved in providing products or services for end users during the production and circulation process. Since a variety of unconventional incidents have occurred more frequently than usual in recent years, the supply and demand markets of goods and services under globalization fluctuate more violently. In addition, the commercial competition environment of the supply chain and the complexity of the internal network structure of the supply chain are constantly increasing with the prevalence of business concepts and production methods, such as centralized production and distribution, lean production, just-in-time production, and noncore business outsourcing. The current supply chain is constantly improving efficiently, but it is also becoming fragile and is easily disrupted by increasing risk challenges [1,2]. As a result, supply chain emergency management has attracted great attention from academia and industry, which has become a rapidly developing and important research field, with an indispensable component of supply chain risk management being considered. Meanwhile, the external environment of the supply chain is more volatile, the risk structure is more complex, and the management difficulty in responding to emergencies is also greater due to differences in economic structure optimization, market maturity, and ecological environment credit construction between different economic regions.

The key to dealing with emergencies is effective decision-making [3,4]. This will lead to different risk decisions when decision makers have different risk preferences and task scenario structures [5–7]. In fact, preference factors have become increasingly prominent in decision-making research as 1 of the 16 issues that need to be focused on in the future management decision-making research field from the complete rationality view of standardized decision-making theory to the bounded rationality view of descriptive decision-making theory to the latest evolutionary decision-making research [8]. In addition, with frequent turbulence in the international economic market, there are objective issues, such as conflicting goals, information asymmetry, and multiple marginalization of cooperation between member enterprises. The evolution of and variation in risk preferences among member enterprises have become a common phenomenon. With the frequent occurrence of emergency events, their severity and urgency make it difficult for member companies to fully make rational decisions, thereby reducing the effectiveness of emergency decision-making in the supply chain, even bringing catastrophic impacts to the supply chain and triggering a series of economic problems.

Therefore, it is important to explore the risk preference characteristics of supply chain member enterprises under emergency events in order to deepen the study of the impact and collaborative mechanism of supply chain member decision-making, thus providing practical guidance for supply chain management theories and methods for enterprises.

As supply chain emergencies are usually complex and uncertain, decision-making under emergencies is usually described as a risk decision. According to prospect theory proposed by Kahneman and Tversky [9], people's risk preferences are affected by different expected return states when faced with the same environment, which would further affect their decision-making behaviors. Weber et al. and Blais et al. [10,11] stated that risk attitude is an important factor that leads to differences between individuals in uncertain decision-making situations. Jun Guo et al. [12] found that the heterogeneity of risk preference is one of the direct causes of emergency decision-making mistakes. Vlaev et al. [13] subdivided financial risk into seven sub-domains and did a fractional analysis and principal component analysis on the risk options of different sub-domains in order to verify the correlation between risk environment and risk preference. Weber [10] studied risk preference in five fields: finance, health and safety, entertainment, ethics, and social decision-making. Marco Angrisani et al. [14] studied whether the COVID-19 pandemic had impacted risk preferences and analyzed the relationship between risk preference, the stock market, and the investment environment.

Considering that the decision-making time in emergencies is urgent and its pressure is huge, scholars have begun to pay more attention to the influence of time pressure on decision-making behavior. Ben and Breznitz [15] were the first scholars to research the influence of time pressure on decision-making. They believed that decision-making is more conservative under the condition of time pressure, which contributes to the re-organization of the frame and the frame effect. Subsequently, relevant scholars studied the influence of time pressure on decision-making behavior from different perspectives. Xiaoguang Liu [16] took students as subjects and found that risk preference and decision-making behavior were affected by time pressure. Gordon Dixon et al. [17] showed that time pressure stimulated decision makers to produce adaptive survival behaviors in emergencies. Liu Dahai et al. [18] assumed that the load rating of UAV operators would be significantly affected by time pressure. Kirchler and Andersson [19] studied decision-makers' behaviors in financial risk projects with time pressure through experiments. Kocher and Schindler [20] found that there were significant differences in coping with time pressure capacity between different selected subjects. El and Krawczyk [21] reported on the time pressure and bidding behavior of participants during the auction. Some researchers also set game tasks with cards or lotteries to study the relationship between time pressure and risk preference [22,23]. Based on the above findings, the risk behaviors with time pressure are heterogeneous in different decision-making areas. More studies are needed to explore how different risk areas affect individual risk attitudes and decision-making strategies.

Based on the above research results, it was found that there are still certain limitations in the research of supply chain emergency management theory and methods, as well as an insufficient fit with the practice of supply chain risk management and the inability to meet the needs of supply chain enterprise risk management. As reflected in the following: (1) The identification of causal factors for supply chain emergencies is not clear enough and systematic analysis is insufficient. There is a lack of research on the influencing factors and characterization of risk preferences under supply chain emergencies. This not only hinders the pace of theoretical research but also affects the scientific premise on which supply chain emergency management relies. (2) Due to the inherent complexity of the supply chain structure and the difficulty in predicting emergencies, research methods mainly rely on qualitative and quantitative analysis, while experimental and empirical research is relatively scarce. Moreover, there is less emphasis on the urgency of emergencies and the pressure of decision-making in terms of research characteristics. These cannot provide an accurate and scientific basis for the management of supply chain emergencies.

This study examined the interaction between time pressure and risk preference, taking time pressure as an external characteristic variable and risk preference as an endogenous variable in supply chain emergencies. Based on the framework of Weber's [10] DOSPERT scale, the content of supply chain conventional risk was adapted and divided into nine fields: morality risk, legal risk, information risk, supply risk, logistical risk, demand risk, cooperation risk, economic risk, and political risk. Moral hazard is reflected in the risk of unethical behavior caused by member enterprises using information asymmetry or the lack of a supervision mechanism. Legal risk refers to the risk caused by the non-standard legal behavior of member enterprises during the operation of the supply chain. Information risk refers to risks caused by inaccurate information transmission, leading to decision-making errors among supply chain members. Supply risk refers to the risks caused by the delayed transportation of goods, interruption of supply, shortage of goods, poor quality, etc. Logistical risk refers to the impact on the operation of the supply chain caused by the inability to provide normal logistics services due to uncertain factors. Demand risk refers to the risk that the supply chain system is confronted with in identifying and meeting customer needs due to the personalization, variability, and randomness of customer demand preferences. Cooperation risk refers to the risk of a "cask effect" or unequal distribution generated by member enterprises when implementing cooperation. Economic risk is the possibility of supply chain losses during operation due to the uncertainty of economic prospects. Political risk refers to the risk of supply chain interruption caused by political, cultural, and other conflicts between countries.

Then, the correlation between the conventional risk fields and the risk preference was analyzed. Based on this, the risk preferences of subjects were measured using prospect theory and Vlaev's [13] questionnaire methods in the scenario of a supply chain emergency. Furthermore, the correlation between risk preference and the environment of supply chain risk decision-making was also explored. Given the time pressure variable (time pressure, no time pressure), the impact of time pressure on the risk preferences of the decision makers was investigated in supply chain emergencies, and the consistency test was carried out on the risk preference of supply chain emergencies with a time pressure variable and conventional risk fields with time pressure. Finally, this study explored the regularity of interaction between risk preference and decision risk frames, time pressure, and other factors to provide an effective methodological reference for the optimization of a supply chain emergency response method and decision management.

2. Experimental Design and Methods

2.1. Experimental Hypothesis

Weber [10] used a five-point scale to test 40 questions on a scale from 5 (very likely) to 1 (very unlikely) and calculated the mean and standard deviation of the test scores. Those higher scores more than one standard deviation above the mean show risk-seeking behavior, those lower scores more than one standard deviation below the mean show risk-averse behavior, and the rest show risk-neutral behavior. Some research showed that the individual risk attitude can be measured and the general trend of risk neutrality can be presented [24]. The gambling behavior and forest fire experiment were analyzed by Tanaka and Bartczak [25,26], respectively. By measuring the risk attitude coefficients α and σ, the characteristics of the probability weighting and risk seeking of the subjects were analyzed. Under the condition of a conventional risk and emergency in a supply chain, the risk preference of a decision maker shows the difference in the emergency decision-making scheme. Therefore, it was assumed that the risk preference of the subjects can be measured in the experiment.

Hypothesis 1 (H1). *The risk preferences of supply chain members can be measured.*

According to the scale test, Weber [10] found that the risk preferences of subjects in the five related fields of finance, health and safety, entertainment, ethics, and social decision-making were inconsistent. Vlaev [13] conducted a questionnaire to analyze the risk preferences of subjects in different fields (gambling, investment, loan to buy a house, income, and insurance). The risk preferences were also inconsistent according to the analysis of Vlaev's questionnaire. Therefore, it was assumed that the risk preferences of the subjects in the conventional risk field of supply chain are inconsistent with that of the emergencies, and are also inconsistent with the natural disasters, production accidents, economic fields, and abnormal accidents of supply chain emergencies.

Hypothesis 2 (H2). *(1) The risk preferences of the nine supply chain conventional fields are not consistent with those of emergencies. (2) The members' risk preferences are inconsistent in natural disaster, production accident, economic field, and abnormal accident supply chain emergencies.*

From three experiments with no time pressure and high and low time pressure, Benson and Beach [27] verified that time pressure could affect a decision-maker's behavior. Liu Xiaoguang [16] and Chen Junlin et al. [24] took students as subjects and found that risk preference and decision-making behavior were affected under time pressure. Ei and Krawczyk [21] investigated the time pressure and bidding behavior of participants using a field auction. Buckert [23] and Kirchler et al. [19] analyzed the relationship between subjects' risk preferences and risk decision-making with lottery tasks. Some scholars also studied the impact of time pressure on risk preference using the unpacking task of risk decision-making [28–30]. At present, there have been many studies about the impact of time pressure on decision-making, and most of them verified that time pressure reduced the quality of decision-making. Therefore, it is important to study whether the risk preference of a member changes with time pressure being added, and if so, what the evolution state is.

Hypothesis 3 (H3). *Time pressure will weaken the risk preference of decision makers in supply chain emergencies.*

2.2. Experimental Design Framework

The overall experiment consisted of three parts. Experiment 1 described the risk preference degree in the conventional risk field of a supply chain and the risk preference consistency between the conventional risk field and the emergency of the supply chain. Experiment 2 studied the risk preference degree of supply chain emergencies. The risk preference consistency of sub-events was evaluated in experiment 3 after the supply chain emergency was divided into four sub-events. Experiments 2 and 3 were conducted with time pressure and no time pressure, which mainly investigated the effect of time pressure on the risk preference degree of supply chain members.

2.3. Experiment 1: The DOSPERT Scale Test of Conventional Risk and Emergency in a Supply Chain

According to the frame form of Weber's scale, nine conventional risk fields with four topics in each field and eight topics about an emergency were set up. All the topics were distributed into the risk preference scale, with a total of 44 topics, as shown in Appendix A.

All topics were determined using the following experiments:

1. Design of the test topics: According to relevant literature about the sorting of supply chain risk, nine key conventional risk fields were identified, namely, moral risk, legal risk, information risk, supply risk, logistics risk, demand risk, cooperation risk, economic risk, and political risk, with each risk field having four topics. For example, in the morality field, one would try to steal the core technology of the other party as a potential competitor when information was shared. Meanwhile, in order to combine the characteristics of supply chain emergencies and the relevance of the research topic, 8 topics regarding supply chain emergencies were selected and compiled. For example, a new acute disease suddenly appeared in the supply workshop, but the workshop was not disinfected because there were not many patients and their infectivity was not ascertained. According to Weber's five-point test scoring, the options from 5 (very likely) to 1 (very unlikely) were set up.
2. Test: 20 voluntary students were selected to fill in the designed questionnaire.
3. Reliability test: We carried out the reliability test using Cronbach's α coefficient on the scale topics through the questionnaire data. The overall data coefficient was measured as 0.911, indicating that the questionnaire had good reliability and could be used for the experiment. The subjects were required to complete all the topics in the questionnaire.

2.4. Experiment 2: Risk Preference Test of Supply Chain Members in Emergencies

According to cumulative prospect theory and the axiomatic weight parameters derived by Drazen Prelec [31] (1998), the values of a piecewise power function were obtained as follows:

$$v(x) = \begin{cases} (x)^{1-\sigma};\ if\ x \geq 0 \\ -\lambda(-x)^{1-\sigma};\ if\ x < 0 \end{cases} \quad (1)$$

The equation probability weighting function is shown in Equation (2):

$$\pi(p) = 1/\exp[\ln[(1/p)]\,\hat{}\,\alpha \quad (2)$$

The concavity of the value function is represented by σ, and the degree of loss aversion is represented by λ. If λ > 1, the decision maker is more sensitive to the loss. If α = 1, then the probability weighting function is linear. If α > 1, then the weighting function is S-shaped, i.e., individuals underweight small probabilities and overweight large probabilities, as shown by Tversky and Kahneman [9]. If α < 1, the weighting function is an inverted S-shape, i.e., individuals overweight small probabilities and underweight large probabilities. The above model reduces to EU (with a reflected utility function at zero) if α = 1 and λ = 1. p is the probability of outcome x.

In order to calculate the prospect theory parameters, two options programs (two series) of the supplies were designed in the rainstorm environment. Different selection programs determined the risk preference of subjects. As shown in Table 1, each series consisted of 14 questions and was divided into options A and B. The difference in the expected value between the programs (A relative to B), that is, the theoretical advantages and disadvantages of option A and option B, is shown in the right column. The probability and expected benefits of A and B were described by referring to Tanaka's design method. The choices were carefully designed so that any combination of choices in the two series determined a particular interval of prospect theory parameter values. In the test of each series, the subject would switch from option A to option B, and the switching point would have values of one or none for each series.

Combinations of approximate values of α, σ, and λ are illustrated in Table 2 for each switching point. "Never" indicates the cases in which a subject does not switch to option B (i.e., always chooses A). The switching points in series 1 and 2 jointly determined α and σ. If multiple switching points appeared, the experiment was considered invalid.

Table 1. The risk preference test questions (unit: ten thousand CNY).

Series 1					Series 2				
Save Supplies Option A		Save Supplies Option B		EV(A) − EV(B)	Save Supplies Option A		Save Supplies Option B		EV(A) − EV(B)
Probability 7/10	Probability 3/10	Probability 1/10	Probability 9/10		Probability 9/10	Probability 1/10	Probability 7/10	Probability 3/10	
250	1000	1700	125	192.5	1000	750	1350	125	−7.5
250	1000	1875	125	175	1000	750	1400	125	−42.5
250	1000	2075	125	150	1000	750	1450	125	−77.5
250	1000	2325	125	130	1000	750	1500	125	−112.5
250	1000	2650	125	97.5	1000	750	1550	125	−147.5
250	1000	3125	125	50	1000	750	1625	125	−200
250	1000	3750	125	−12.5	1000	750	1700	125	−252.5
250	1000	4625	125	−100	1000	750	1800	125	−322.5
250	1000	5500	125	−187.5	1000	750	1925	125	−410
250	1000	7500	125	−387.5	1000	750	2075	125	−515
250	1000	10,000	125	−637.5	1000	750	2250	125	−637.5
250	1000	15,000	125	−1137.5	1000	750	2500	125	−812.5
250	1000	25,000	125	−2137.5	1000	750	2750	125	−987.5
250	1000	42,500	125	−3887.5	1000	750	3250	125	−1337.5

Table 2. Coefficient reference table of α and σ in series 1 and series 2.

Series 1								Series 2							
σ	α							σ	α						
	0.4	0.5	0.6	0.7	0.8	0.9	1		0.4	0.5	0.6	0.7	0.8	0.9	1
0.2	9	10	11	12	13	14	NO	0.2	NO	14	13	12	11	10	9
0.3	8	9	10	11	12	13	14	0.3	14	13	12	11	10	9	8
0.4	7	8	9	10	11	12	13	0.4	13	12	11	10	9	8	7
0.5	6	7	8	9	10	11	12	0.5	12	11	10	9	8	7	6
0.6	5	6	7	8	9	10	11	0.6	11	10	9	8	7	6	5
0.7	4	5	6	7	8	9	10	0.7	10	9	8	7	6	5	4
0.8	3	4	5	6	7	8	9	0.8	9	8	7	6	5	4	3
0.9	2	3	4	5	7	8	9	0.9	8	7	6	5	4	3	2
1	1	2	3	4	5	6	7	1	7	6	5	4	3	2	1

From the switching table, two data matching the switching point were analyzed to obtain α and σ, which determined the risk preference of the subjects. The combinations of α and σ of each switching point are shown in Table 2. For example, if the switching point was considered for question 6 in series 1, the combinations of (α, σ) were (0.4, 0.5), (0.5, 0.6), (0.6, 0.7), (0.7, 0.8), (0.8, 0.9), and (0.9, 1.0). If the switching point was considered for question 4 in series 2, the combinations of (α, σ) were (1.0, 0.7), (0.9, 0.8), (0.8, 0.9), and (0.9, 1.0). By combining the two series of turning points, the value of (α, σ) was (0.8, 0.9).

With the time pressure value setting being considered, the research methods put forward by Benson and Beach were applied [27]. In order to verify the influence of time pressure on decision-making behavior, Benson and Beach defined the value obtained by subtracting one standard deviation from the mean decision time with no time pressure record as the low time pressure and 1/2 of the mean as the high time pressure. In this experiment, the mean time and standard deviation of the subjects in the two series were 220 s and 50 s, respectively, with no time pressure. Therefore, the low time pressure was set to 220 − 50 = 170 s.

2.5. Experiment 3: Risk Preference Test of Supply Chain Emergent Sub-Events

In terms of the definition and classification of a supply chain emergency, a consistent opinion has not currently been formed in the academic circle. A representative study, such as Mitroff's [32] classification of a supply chain emergency, showed that emergencies include natural disasters, production accidents, and abnormal accidents (such as a robbery, artificial panic, and strike). Some scholars divided supply chain emergencies into subjective factors, objective factors, and environmental factors [33]. Based on the classified statistics of relevant studies, the supply chain emergency was divided into four sub-events in this study: natural disaster, production accident, economy field, and abnormal accident, and the risk preferences of subjects were tested in the corresponding sub-events.

Vlaev [13] (2010) made the subjects choose schemes in four scenarios of the financial risk field, including a deterministic return y and a risky return x (p chance of x). Therefore, our experiment had a profit and loss generated by the decision-making scheme of a supply chain emergency. Each pair of the chosen schemes was presented as two options A and B. The two options of the chart represented risky returns indicating the probabilities for gain versus nothing, respectively (see Appendix B). The value of the risk return x was represented by a risk probability (20%, 40%, 60%, 80%) and the corresponding return (300, 600, 900, 1200). Each risk scenario produced 16 schemes when y and x were crossed and paired to design risky schemes. The accompanying certainty was generated by using a power law utility function with power γ so that a person with power γ would be indifferent between the sure thing and the risk. The utility function was used to measure the relevance and dependence of risk preference in supply chain emergent sub-events. The utility function formula is shown in (3):

$$y = x\,p^{(1/\gamma)}, \tag{3}$$

In the above formula, p represents the probability of the risk return x. γ represents the utility bending degree of the utility function $u(x) = x^{\gamma}$, which is also the risk preference coefficient of the decision maker. $\gamma = 1$ means risk neutral. The smaller γ is, the more risk-averse the decision maker is. In a specific supply chain emergency scenario, four values of γ were used (0.35, 0.5, 0.65, 0.8) when someone much less risk-averse would select the sure thing when even the most risk-averse would select the risky option. The idea here is that a more risk-seeking person tends to choose the prospects in the "risky" options, while a more risk-averse person tends to choose the sure amounts in the "risky" options and the prospects of the "safe" choice schemes. Definitely, very risk-seeking persons would choose only the risky option and very risk-averse subjects will choose only the sure amounts. The value of γ corresponds to the given value of γ for each design scheme. The mean value of γ selected by all the subjects was calculated, which was also the risk preference coefficient of the subjects. Values of γ were randomly assigned to options with the constraint that each value of γ occurred once for each amount and once for each probability. There were 64 ($4 \times 4 \times 4$) kinds of possible schemes of risk decisions that could be generated by composing values of the γ, prospect amount, and four levels of probability.

Presenting all subjects with all 64 schemes in each scenario would be a demanding task. In order to facilitate the effective implementation of the experiment, 16 composition schemes were selected considering that all four kinds of γ values could be paired with x and p in each emergent sub-event. However, it is certain that at least each scenario presented all four levels of γ paired with every monetary amount and probability. In order to avoid the sequence of the same γ values in a different risk event, γ values were assigned to four groups according to a certain sequence, and then the four groups were arranged in random order as follows: the first group (0.35, 0.5, 0.65, 0.8), the second group (0.8, 0.35, 0.5, 0.65), the third group (0.65, 0.8, 0.35, 0.5), and the fourth group (0.5, 0.65, 0.8, 0.35). Therefore, the randomness and irregularity of the orders and probabilities under different emergent events were ensured in order to avoid the influence of the order on the subject's decision-making.

2.6. Subject Statistics and Experimental Procedures

The experiments were divided into three groups. The first group was the DOSPERT scale test of risk preference in the conventional risk and emergency of the supply chain. In the second group, the risk preference of members was tested when the supplies were in a rainstorm. The third group was the risk preference test of supply chain emergent sub-events. Among them, the second and third groups were divided into a time-pressure test and a no-time-pressure test. A total of 400 supply chain employees were investigated in different industries in this experiment, among which 332 valid questionnaires were obtained. The specific positions were management positions, such as sales manager, operation manager, technical director, and production operation manager. The survey area was in the western provinces of China. The statistics of the subject data information are shown in Table 3.

Table 3. Subjects statistics.

	Gender		Management Position		
	Men	**Women**	**Sales**	**Operation**	**Technology**
Number of people	220	112	168	104	60
Proportion	66.27%	33.73%	50.60%	31.33%	18.07%

All the experimental programs were completed on the computer by using z-tree software. Before filling in the questionnaire, we ensured that the respondents fully understood the contents and procedures of the questionnaire. First, the subjects completed the DOSPERT test of risk preference in the conventional risk and emergency field of the supply chain. After having a 3 min rest, the procedures of experiment 2 were explained to subjects, who then completed the questionnaire of experiment 2. After a 3 min rest, the procedure of the first emergent sub-events of experiment 3 was explained to subjects who completed the questionnaire under this sub-event. Then, the subjects completed the experiment of the remaining three sub-events in turn. In experiment 1, the subjects received a fixed reward of CNY 50. The rewards of experiments 2 and 3 were calculated based on the subjects' choices, and the cumulative sum was obtained by multiplying a dwindling coefficient. The reward for completing experiment 2 was between CNY 25 and 45, and that of experiment 3 was between CNY 30 and 50. The total reward to the subject was between CNY 105 and 145.

3. Results

3.1. Data Analysis of Experiment 1

The reliability test of the questionnaire showed that the coefficient of the overall Cronbach's α was 0.865, which indicated the good consistency of the questionnaire. The normality test of experiment 1 indicated that the p-value was 0.582, which showed a normal distribution. A t-test was conducted on the samples with the result of $p > 0.05$, which indicated that the difference between the two was not statistically significant.

As shown in Table 4, in general, the proportion of risk neutrality for the subjects was 65.6% in experiment 1, and the proportions of risk aversion and seeking were 18% and 16.4%, respectively. The proportions of risk aversion and seeking for subjects were not outstanding. In the ten risk fields for a supply chain, namely, morality, law, information, supply, logistics, demand, cooperation, economy, politics, and emergency, the risk preference distribution of the subjects was slightly different. That is, the risk preferences of the subjects in the supply chain emergency field were relatively consistent with that of the conventional risk field. It should be noted that the subjects showed more risk aversion or risk seeking in the risk fields of information, logistics, and cooperation than in other risk fields; the lower-risk-aversion or higher-risk-seeking characteristics were shown in the risk field of morality; the higher-risk-aversion or lower-risk-seeking characteristics were shown in the supply risk.

Table 4. The distribution of risk preferences in the supply chain risk field.

Risk Areas	Risk Neutrality	Risk Aversion	Risk-Seeking	Risk Areas	Risk Neutrality	Risk Aversion	Risk-Seeking
Morality	231	41	60	Demand	232	48	52
Law	228	60	44	Cooperation	212	60	60
Information	209	67	56	Economy	235	53	44
Supply	228	64	40	Politics	220	52	60
Logistics	212	60	60	Emergency	215	57	60

The study further analyzed the same subject's risk preference in ten risk fields. It was found that no subject always showed risk-averse or risk-seeking behavior, and 44 subjects always showed risk neutrality. The inconsistency of the risk preference distribution for subjects in ten risk fields was 86.7%. Therefore, it can be concluded that individuals' preferences in different supply chain risk fields were not consistent, as shown in Table 5.

Table 5. Risk preference distribution of individuals in the supply chain risk fields.

	Total Risk Aversion	Risk Aversion or Neutrality	Total Risk Neutrality	Risk Seeking or Neutrality	Total Risk Seeking	All Three Have
Total	0	92	44	104	0	92

Conclusion 1: In general, the risk preferences of the members could be measured and were consistent in the conventional risk fields and emergencies of a supply chain; the risk preferences of decision makers in the ten fields were not consistent from an individual perspective. These results did not reject hypothesis 1 but rejected the first part of hypothesis 2.

3.2. Data Analysis of Experiment 2

Through the statistics of the turning points of all subjects, all (α, σ) combinations were obtained, and the means of α and σ were calculated. The mean was the coefficient that measured the risk preference degrees of the subjects. Specifically, in the supplies emergency scenario, the turning point values of 26 groups' (α, σ) combinations with no time pressure and 38 groups' (α, σ) combinations with time pressure were obtained. The mean of (α, σ) with no time pressure was (0.909, 0.917), and the mean of (α, σ) with time pressure was (0.702, 0.798). This shows that supply chain members tended to avoid risks with no time pressure in emergencies, and the degree of risk aversion was weakened with time pressure.

Figure 1 shows the turning point distribution of the subjects. The numbers on the coordinate axes represent the turning points of series 1 and 2, and the height of each cone represents the number of subjects at the turning points. The black areas indicate the turning point of α = 1, which describes the situation of risk aversion. As can be seen from the figure above, the turning points with no time pressure were more densely distributed near the black areas; the turning points with time pressure were more dispersed and were far from the black areas. It is shown that the risk preference of subjects tended to be in the state of risk aversion with no time pressure, and the degree of risk aversion was strong. However, the subjects gradually weakened their risk aversion with time pressure.

It should be noted that the risk appetite coefficient in this experiment with no time pressure was quite different from the values estimated by Weber [10], who took residents of South Asian countries, and Elaine Liu (2008) [34], who took Chinese farmers as subjects. As shown in Table 6, the risk preferences of decision makers were also different when there were differences in, e.g., the decision-making scenario, market environment, personal knowledge structure, and economic income. Influenced by the market economy for many years, Chinese supply chain members have become more risk-averse, and their economic behavior and maturity are gradually improving. The coefficients of risk preference with time pressure in this experiment were smaller than those obtained by Chen Junlin [24] (2015), who took Chinese students as subjects in an emergency environment, as shown in Table 7. It should be noted that unlike the student participants, the subjects were employees of a supply chain. As a result, it shows that the decision-making behavior of Chinese supply chain economies did not reflect a high degree of risk aversion, regardless of time pressure or the lack thereof. Therefore, it also reconfirms that the experimental conclusion found when taking students as the subjects cannot be applied to the management practice of supply chain emergencies.

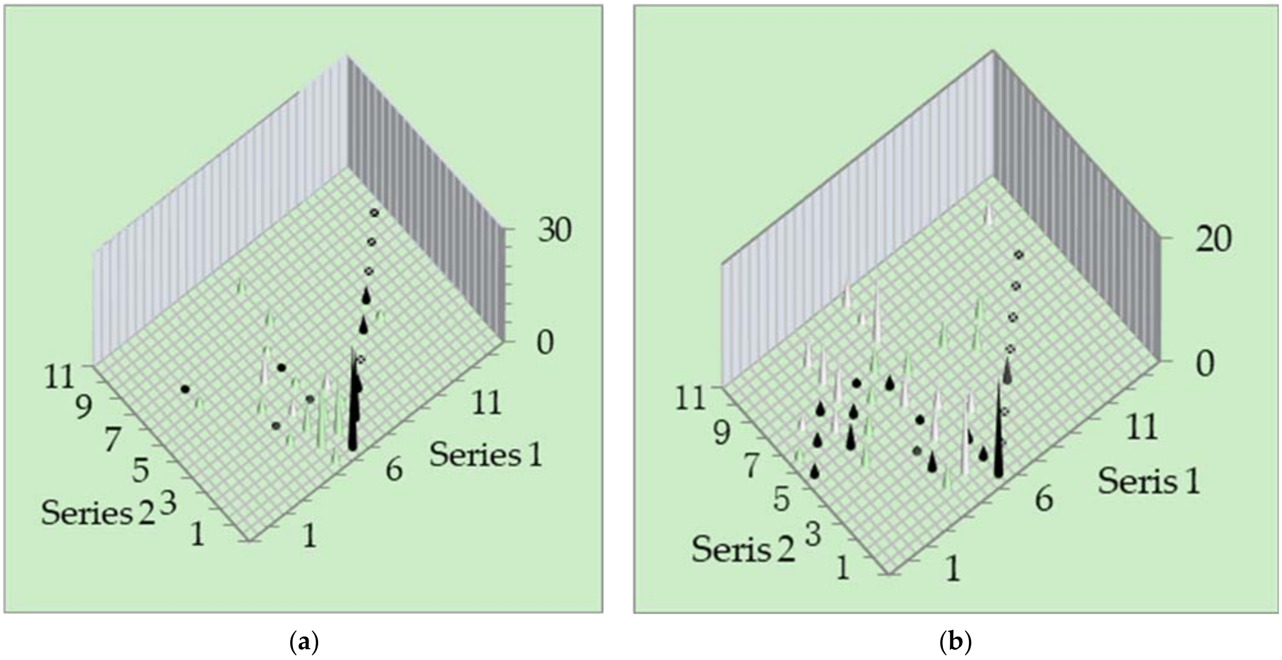

Figure 1. The distribution diagrams of the turning points: (**a**) the distribution of turning points with no time pressure; (**b**) the distribution of turning points with time pressure.

Table 6. Experimental parameters of the subjects in different fields.

The Subjects	The Experiment Field	σ	α
Residents in South Asia	Lottery experiment	0.59	0.74
Chinese farmers	Planting field	0.48	0.69
Supply chain members in China	Supply chain risk	0.91	0.92

Table 7. Experimental parameters of the subjects with time pressure.

The Subjects	The Experiment Field	No Time Pressure		Time Pressure	
		σ	α	σ	α
Students	Emergency field	0.956	0.944	0.833	0.85
Supply chain members	Supply chain risk	0.909	0.917	0.702	0.8

Conclusion 2: The risk preference of members could be measured in the emergency response of the supply chain, and the subjects showed a risk aversion trend. This did not support the rejection of hypothesis 1; the risk aversion degree of the subjects was weakened with time pressure. Hypothesis 3 was not rejected.

3.3. Data Analysis of Experiment 3

The experimental data of two groups from four emergency scenarios were tested in the field of supply chain emergent sub-events, with the asymptotic significances of the no time pressure and time pressure groups being 0.983 and 0.747, respectively, which were greater than 0.05. Thus, there was no significant difference between the γ values of the two groups. Then, the pairwise comparison of four kinds of γ values was conducted according to the two groups of experimental data. There were a total of 12 groups of γ value combinations, and the *t*-test was conducted on them. The maximum p was 0.775, which was obtained using the test, corresponding to production accidents and economic fields with time pressure; the minimum p was 0.155, corresponding to the natural disaster and abnormal accident scenarios in the no-time-pressure group. All tested p-values were greater than 0.05, showing that the difference was not statistically significant. It was confirmed that the test results of all data met the necessary conditions, meaning further analysis was required.

As shown in the Figure 2 on the whole, the value of γ fluctuated slightly around 0.5, which indicated that different types of emergencies in the supply chain were relatively consistent with the risk preferences of the subjects with time pressure. Meanwhile, time pressure weakened the risk aversion degree of the subjects, which was also consistent with the partial conclusion of experiment 2. Further analysis showed that the natural disaster had a greater impact on the risk preference of subjects with time pressure, while the production accident, economy field, and abnormal accident had smaller impacts.

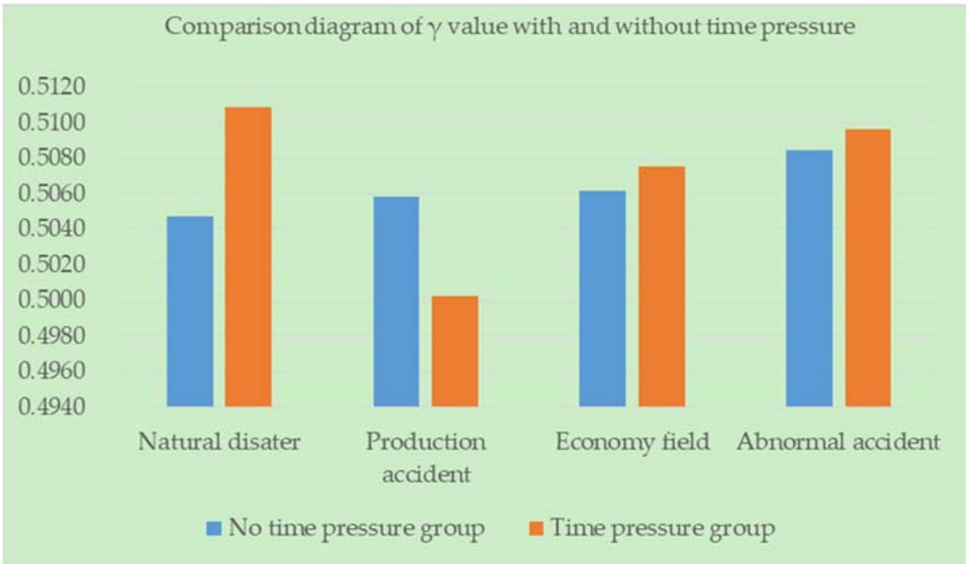

Figure 2. Risk preferences of the supply chain emergency sub-events.

Furthermore, the standard deviation and extreme value of γ were further analyzed in the four scenarios. As shown in Table 8, the difference in the standard deviation between the two groups of experiments was smaller, which indicated better stability of decision-making. The standard deviation of the γ values with time pressure was larger than with no time pressure, which showed that time pressure reduced the stability of the decision-makers' risk preferences.

Conclusion 3: The risk preference of the subjects showed consistency for the natural disaster, production accident, economic field, and abnormal accident. The second part of hypothesis 2 was rejected. Time pressure had a great influence on the risk preference of decision makers in the natural disaster scenario, which showed the alleviation of the degree of risk aversion. However, the time pressure had little influence on the risk preferences of the decision makers regarding the production accident, economic field, and abnormal accident. Therefore, hypothesis 3 was rejected.

Table 8. Statistical table of γ values with time pressure and no time pressure.

	No Time Pressure					Time Pressure				
	Total	The Mean	The Standard Deviation	The Maxi-Mum	The Mini-Mum	Total	The Mean	The Standard Deviation	The Maxi-Mum	The Mini-Mum
Natural disaster	166	0.505	0.030	0.566	0.444	166	0.511	0.048	0.575	0.425
Production accident	166	0.506	0.037	0.575	0.444	166	0.500	0.032	0.575	0.425
Economy field	166	0.506	0.033	0.575	0.425	166	0.508	0.038	0.575	0.425
Abnormal accident	166	0.508	0.041	0.566	0.425	166	0.510	0.044	0.575	0.425

4. Discussion

In summary, the risk preferences of the supply chain members could be measured regarding the conventional risk and emergency. Compared with the results of Weber's [10] research, participants showed greater changes in the range of risk preference and risk avoidance in the experiment of the nine major conventional risks and emergency areas of the supply chain. For example, the total number of Weber's participants was 116 students, of which approximately 18 were risk-averse and another approximately 18 were risk-seeking. The total number of participants in this experiment was 332 individuals from different professions, with a range of 40–70 for risk aversion and 40–60 for risk seeking. The overall risk preference varied more between individuals. Compared with Weber's experiment, the overall average risk-neutral proportion of participants was slightly lower. In terms of risk-seeking, the overall proportion was slightly higher. In terms of risk aversion, the overall proportion was also slightly higher. From an individual perspective, compared with Weber's experiment, the significant change was the significant decrease in the number of participants who consistently exhibited risk neutrality.

Taking the supplies rescue as the scenario, it was found that time pressure weakened the risk aversion degree of subjects. Compared with previous experimental research [25,34], Chinese supply chain members became more risk-averse, and their economic behavior and maturity are gradually improving.

By introducing the time pressure into four types of supply chain emergency scenarios with a natural disaster, production accident, economic risk, and abnormal accident, it was found that the time pressure only increased the risk aversion degree of decision makers in a natural disaster. Combining experiments 1 and 3, it was found that the risk preference of decision makers in emergencies was consistent with the conventional risk of the supply chain, while the individual risk preferences of the decision makers in the different supply chain risk fields were inconsistent. Decision makers were more risk-averse and individuals were consistent in different emergencies in the natural disaster, production accident, economic risk, and abnormal accident conditions.

Therefore, hypothesis 1 was not rejected. Regarding the supplies rescue, hypothesis 3 was not rejected. In the natural disaster supply chain emergency, both hypothesis 2 and hypothesis 3 were rejected.

5. Conclusions

This study aimed to measure the risk preferences of members from the perspective of supply chain risk. The risk of a supply chain was divided into conventional risk and emergency categories, and the consistency test of risk preference data was conducted in the corresponding risk fields. Supply chain emergencies were specified into sub-emergencies, and consistency tests of risk preference were conducted in the corresponding sub-emergencies. Overall, three experiments were conducted in this study. In experiment 1, Weber's scale framework was taken as a reference to design nine conventional risk fields of the supply chain, and the consistency of risk preferences was tested for corresponding supply chain risk fields after combining the designed supply chain emergencies with conventional risks.

In experiment 2, the questionnaires were designed by referring to the weight function and value function of prospect theory to investigate the risk preference of decision makers who considered the supplies rescue scenario. In experiment 3, the risk preferences of decision makers were investigated when the supply chain was affected by a natural disaster, production accident, economic field, and abnormal accident. In experiment 2 and experiment 3, the influence of time pressure on the decision-makers' risk preferences was compared and analyzed after the time pressure variables were introduced.

Based on the above experimental analysis, the conclusions were as follows:

The preferences of decision makers regarding the conventional risk were consistent with the preferences of the emergency in the supply chain, while the risk preference of the same subject was inconsistent in different fields. Decision makers tended to show risk aversion in the supply chain emergencies, while the degree of risk aversion decreased with time pressure.

The risk aversion degree of the subjects was similar in the conditions of the four sub-events of supply chain emergencies (natural disaster, production accident, economic field, abnormal accident). The risk preference degrees of the subjects were weakened after the time pressure test. At the same time, the time pressure had a great impact on the risk preferences of the subjects in the natural disaster condition and had small effects in the production accident, economic field, and abnormal accident scenarios.

This research result has practical significance to supply chain risk and emergency management. It demonstrated that the risk preferences of supply chain members could be measured, and the preferences were also different in different risk fields and conditions of time pressure. The research methods could be used in the practice management of supply chain risks and emergencies and could provide empirical support for the risk preferences identification and the coordination of supply chain risk management. The study also verified that the risk aversion of supply chain members was weakened after time pressure was introduced. It requires that decision makers, especially the core members of the supply chain, pay more attention to the risk preferences of the cooperative enterprises when making emergency decisions so that they can choose a reasonable coordinated response plan.

The research methods used in this study can provide ideas for subsequent research, which can be expanded greatly. For example, the influence of time pressure intensity on member preferences can be further studied, and whether time pressure will have a certain critical value remains to be analyzed. In addition, under a multi-emergency scenario, the evolution trend and the consistency of risk preference need to be further investigated.

Author Contributions: Conceptualization, Y.G. and W.C.; methodology, Y.G.; software, W.C.; validation, Y.G.; formal analysis, Y.G.; investigation, Y.G. and W.C.; data curation, W.C.; writing—original draft preparation, Y.G. and H.L.; writing—review and editing, Y.G. and H.L.; funding acquisition, Y.G. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by National Key R&D Projects, grant number 2020YFB1713300; the Special Fund Project for Basic Scientific Research of the Central Higher Education Institutions, grant number 300102229107; and the National College Student Entrepreneurship Practice Project, 202210710007.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Data can be available from the corresponding author upon request.

Acknowledgments: The authors wish to thank the reviewers for their invaluable comments and suggestions that enhanced the quality of this paper.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Questionnaire 1: supply chain risk and supply chain emergency risk DOSPERT scale test

For each of the following statements, please indicate the likelihood of engaging in each activity. Provide a rating from 1 to 5, using the following scale:

1	2	3	4	5
○	○	○	○	○
Extremely unlikely		Not sure		Extremely likely

1. ____ Interrupting the normal progress of the project and taking over additional projects with considerable revenue. (MR)
2. ____ Not making sure to complete the cooperation project on time and not ensuring the quality according to the requirements when the agreed income is reduced by 20%. (MR)
3. ____ Trying to steal their core technology as a potential competitor when information is shared. (MR)
4. ____ Believing distributions should be fair between the amount of work and income when cooperating with others. (MR)
5. ____ Terminating the contract with the current partner early when there is a better partner. (LER)
6. ____ Not taking the lead in energy saving and emission reduction when sacrificing 15% of net income to introduce green technology. (LER)
7. ____ Priority on productivity and neglecting workplace health and safety. (LER)
8. ____ Paying not too much attention to partners' sense of social responsibility. (LER)
9. ____ Purchasing a large number of raw materials for processing and sales when market demand suddenly booms. (IR)
10. ____ Increasing orders in order to get more quotas when product is rationed. (IR)
11. ____ Not telling partners information that is harmful to them but beneficial to you. (IR)
12. ____ Spreading some untrue information to promote sales when inventory is overstocked. (IR)
13. ____ Paying more attention to the quality compared to the safety and environmental protection issues of suppliers. (SR)
14. ____ Cooperating with raw material suppliers in disaster-prone areas. (SR)
15. ____ Competing with the manufacturer for downstream market when the manufacturer is absolutely dependent on you as a supplier. (SR)
16. ____ Prioritizing to meeting important customer orders rather than supplying in order. (SR)
17. ____ Risking to pass a poor road that has not been taken before in order to deliver the goods to a disaster area on time. (LOR)
18. ____ Driving over the speed limit on the endless road with few people and cars when transporting goods without monitoring. (LOR)
19. ____ Cooperating with carriers unable to implement effective monitoring. (LOR)
20. ____ Continuing to accept order even when the delivery time is delayed due to excessive orders. (LOR)
21. ____ Relying on a certain supplier for the supply of important raw materials. (DR)
22. ____ Cooperating with low loyalty partners due to the excellent quality of products. (DR)
23. ____ Prioritizing to meet the delivery time for unstable key customers and delaying the delivery time for small customers with long-term cooperation. (DR)
24. ____ Continuing to increase output although it is impossible to predict the demand in the peak sales period. (DR)
25. ____ Sharing your own core technologies on the basis of mutual trust between enterprises. (CR)
26. ____ Reducing real-time monitor for long-term service providers. (CR)
27. ____ Cooperating with enterprises with bad reputation. (CR)

28. ____ Choosing to maximize the interests of enterprises at the expense of the overall interests of the supply chain. (CR)
29. ____ Investing 30% of the idle capital of the enterprise in risk stocks (high risk of stocks, but also high returns). (ER)
30. ____ Investing 60% of idle funds of enterprises in government bonds (Low risk of bond, but also low returns). (ER)
31. ____ Investing 30% of the idle capital of the enterprise in the fixed deposit of the bank (low risk of deposit, but also low returns). (ER)
32. ____ Investing 60% of idle funds of enterprises in mutual funds with moderate growth. (ER)
33. ____ Investing in regions with a historical tendency of "excluding China". (PR)
34. ____ Purchasing raw materials in areas threatened by terrorism to obtain low cost of the raw materials. (PR)
35. ____ Building factories in countries with frequent regime changes in order to obtain cheap labor costs. (PR)
36. ____ Debating with foreign cooperative enterprise decision-makers on issues with different opinions on political differences between two countries. (PR)
37. ____ Refusing to discard valuables that affect running speed when escaping in debris flow. (EM)
38. ____ Not disinfecting the workshop when new acute diseases appear in the production workshop due to few patients and their uncertain infectivity. (EM)
39. ____ Repairing the production machine by oneself when it breaks down. (EM)
40. ____ Loading items beyond the loading capacity of the sterilization cabinet. (EM)
41. ____ Stopping to help a person on the road with few people when transporting goods at night. (EM)
42. ____ Confronting with thieves when valuable goods of enterprise are stolen at night. (EM)
43. ____ Breaking into the burning room to get the key technical materials. (EM)
44. ____ Not reducing production when many other enterprises have been revealed by media due to counterfeit and shoddy products. (EM)

Note: MR = morality risk, LER = legal risk, IR = information risk, SR = supply risk, LOR = logistics risk, DR = demand risk, CR = cooperation risk, ER = economy risk, PR = politics risk. EM = emergency.

Appendix B

Questionnaire 2: The risk DOSPERT scale test of supply chain emergent sub-events.

Scenarios 1: Natural Disaster.

Under the condition that the parts supply warehouse you are responsible for suddenly seeps due to the continuous heavy rainfall, it is necessary to quickly transfer the equipment and raw materials on site to minimize the loss. As the person in charge of emergency decision-making, you arrange staff to enter the warehouse to transfer equipment and raw materials. At this moment, the ground water level of the warehouse suddenly rises rapidly, but the equipment and raw materials have not been transferred completely. If there are two transfer schemes, "To save a certain amount of property" or "It is possible to save property, and it may be damaged completely", which one would you choose?

1. A:100% save 30,000 ¥	9. A:100% save 750,000 ¥
B: 20% save 3,000,000 ¥, 80% save 0.	B: 20% save 9,000,000 ¥, 80% save 0.
2. A:100% save 480,000 ¥	10. A:100% save 2,850,000 ¥
B: 40% save 3,000,000 ¥, 60% save 0.	B: 40% save 9,000,000 ¥, 60% save 0.
3. A:100% save 1,380,000 ¥	11. A:100% save 2,100,000 ¥
B: 60% save 3,000,000 ¥, 40% save 0.	B: 60% save 9,000,000 ¥, 40% save 0.

4. A:100% save 2,280,000 ¥ B: 80% save 3,000,000 ¥, 20% save 0.	12. A:100% save 5,760,000 ¥ B: 80% save 9,000,000 ¥, 20% save 0.
5. A:100% save 240,000 ¥ B: 20% save 6,000,000 ¥, 80% save 0.	13. A:100% save 1,590,000 ¥ B: 20% save 12,000,000 ¥, 80% save 0.
6. A:100% save 1,470,000 ¥ B: 40% save 6,000,000 ¥, 60% save 0.	14. A:100% save 870,000 ¥ B: 40% save 12,000,000 ¥, 60% save 0.
7. A:100% save1,470,000 ¥ B: 40% save 6,000,000 ¥, 60% save 0.	15. A:100% save 4,320,000 ¥ B: 60% save 12,000,000 ¥, 40% save 0.
8. A:100% save 3,180,000 ¥ B: 60% save 6,000,000 ¥, 40% save 0.	16. A:100% save 8,520,000 ¥ B: 80% save 12,000,000 ¥, 20% save 0.

Scenarios 2: Production Accident.

The quality of a supplier's raw material does not meet the requirements due to technical defects and is returned by the manufacturer. As a result, the production of manufacturers was interrupted due to insufficient supply of raw materials. At this time, the manufacturer has two choices: to wait for the raw material supplier to re supply, but within a certain period of time, the raw material supply is limited and the income is small; or to choose a new raw material supplier in the market. Due to the strict technical requirements for raw material supply, it will be possible that there is no qualified suppliers in the current market if supplier is reselected and the cooperation opportunities with the original suppliers is lost. If there are two options: "Wait for the supply of the original supplier to save a certain amount of property", or "Look for a new supplier which is possible to save property, and it is possible to lose all", which one would you choose?

1. A:100% save 240,000 ¥ B: 20% save 3,000,000 ¥, 80% save 0.	9. A:100% save 90,000 ¥ B: 20% save 9,000,000 ¥, 80% save 0.
2. A:100% save 960,000 ¥ B: 40% save 3,000,000 ¥, 60% save 0.	10. A:100% save 1,440,000 ¥ B: 40% save 9,000,000 ¥, 60% save 0.
3. A:100% save 690,000 ¥ B: 60% save 3,000,000 ¥, 40% save 0.	11. A:100% save 4,110,000 ¥ B: 60% save 9,000,000 ¥, 40% save 0.
4. A:100% save1,920,000 ¥ B: 80% save 3,000,000 ¥, 20% save 0.	12. A:100% save 6,810,000 ¥ B: 80% save 9,000,000 ¥, 20% save 0.
5. A:100% save 810,000 ¥ B: 20% save 6,000,000 ¥, 80% save 0.	13. A:100% save 480,000 ¥ B: 20% save 12,000,000 ¥, 80% save 0.
6. A:100% save 450,000 ¥ B: 40% save 6,000,000 ¥, 60% save 0.	14. A:100% save 2,940,000 ¥ B: 40% save 12,000,000 ¥, 60% save 0.
7. A:100% save2,160,000 ¥ B: 60% save 6,000,000 ¥, 40% save 0.	15. A:100% save 6,330,000 ¥ B: 60% save 12,000,000 ¥, 40% save 0.
8. A:100% save 4,260,000 ¥ B: 80% save 6,000,000 ¥, 20% save 0.	16. A:100% save 6,330,000 ¥ B: 80% save 12,000,000 ¥, 20% save 0.

Scenarios 3: Economic Field Accident.

There are only food production enterprises A and B in a region. Enterprises A was suddenly exposed by the media: it cooperated with upstream suppliers to cheat and illegally use inferior milk sources or additives. This matter has a great social impact in the region. At this time, as the chief of enterprise B, although the product quality meets the standard, emergency decision must be made at this time. There are two options: To reduce the production on a large scale to obtain a certain amount of income; to expand production capacity and take the opportunity to squeeze the market of enterprise A. However, it is possible to gain more profits or lose a heavy profit of zero. Which one would you choose?

1. A:100% save 390,000 ¥ B: 20% save 3,000,000 ¥, 80% save 0.	9. A:100% save 360,000 ¥ B: 20% save 9,000,000 ¥, 80% save 0.
2. A:100% save 210,000 ¥ B: 40% save 3,000,000 ¥, 60% save 0.	10. A:100% save 2,190,000 ¥ B: 40% save 9,000,000 ¥, 60% save 0.

3. A:100% save 1,080,000 ¥	11. A:100% save 4,740,000 ¥
B: 60% save 3,000,000 ¥, 40% save 0.	B: 60% save 9,000,000 ¥, 40% save 0.
4. A:100% save2,130,000 ¥	12. A:100% save 4,770,000 ¥
B: 80% save 3,000,000 ¥, 20% save 0.	B: 80% save 9,000,000 ¥, 20% save 0.
5. A:100% save 60,000 ¥	13. A:100% save 1,020,000 ¥
B: 20% save 6,000,000 ¥, 80% save 0.	B: 20% save 12,000,000 ¥, 80% save 0.
6. A:100% save 960,000 ¥	14. A:100% save 3,810,000 ¥
B: 40% save 6,000,000 ¥, 60% save 0.	B: 40% save 12,000,000 ¥, 60% save 0.
7. A:100% save2,730,000 ¥	15. A:100% save 2,790,000 ¥
B: 60% save 6,000,000 ¥, 40% save 0.	B: 60% save 12,000,000 ¥, 40% save 0.
8. A:100% save 4,530,000 ¥	16. A:100% save 7,680,000 ¥
B: 80% save 6,000,000 ¥, 20% save 0.	B: 80% save 12,000,000 ¥, 20% save 0.

Scenarios 4: Abnormal Accident.

A valuable raw material warehouse is located in a border area. A gang of thieves broke in suddenly at night. At this time, there are two options: To take it by the thief, and the remaining property will be saved; to resist the thieves and the property may be saved or all of it may be lost. Which one would you choose?

1. A:100% save 120,000 ¥	9. A:100% save 1,200,000 ¥
B: 20% save 3,000,000 ¥, 80% save 0.	B: 20% save 9,000,000 ¥, 80% save 0.
2. A:100% save 720,000 ¥	10. A:100% save 660,000 ¥
B: 40% save 3,000,000 ¥, 60% save 0.	B: 40% save 9,000,000 ¥, 60% save 0.
3. A:100% save 1,590,000 ¥	11. A:100% save 3,240,000 ¥
B: 60% save 3,000,000 ¥, 40% save 0.	B: 60% save 9,000,000 ¥, 40% save 0.
4. A:100% save1,590,000 ¥	12. A:100% save 6,390,000 ¥
B: 80% save 3,000,000 ¥, 20% save 0.	B: 80% save 9,000,000 ¥, 20% save 0.
5. A:100% save 510,000 ¥	13. A:100% save 120,000 ¥
B: 20% save 6,000,000 ¥, 80% save 0.	B: 20% save 12,000,000 ¥, 80% save 0.
6. A:100% save 1,920,000 ¥	14. A:100% save 1,920,000 ¥
B: 40% save 6,000,000 ¥, 60% save 0.	B: 40% save 12,000,000 ¥, 60% save 0.
7. A:100% save1,380,000 ¥	15. A:100% save 5,460,000 ¥
B: 60% save 6,000,000 ¥, 40% save 0.	B: 60% save 12,000,000 ¥, 40% save 0.
8. A:100% save 3,840,000 ¥	16. A:100% save 9,090,000 ¥
B: 80% save 6,000,000 ¥, 20% save 0.	B: 80% save 12,000,000 ¥, 20% save 0.

References

1. Stephan, M.; Christoph, B. An Empirical Examination of Supply Chain Performance Along Several Dimensions of Risk. *J. Bus. Logist.* **2008**, *29*, 307–325.
2. Coleman, L. Frequency of Man-Made Disasters in the 20th Century. *J. Conting Cris.* **2006**, *38*, 131–156. [CrossRef]
3. Lench, H.C.; Flors, S.A.; Bench, S.W. Discrete Emotions Predict Changes in Cognition, Judgment, Experience, Behavior, and Physiology: A Meta-Analysis of Experimental Emotion Elicitations. *Psychol. Bull.* **2011**, *23*, 126–130. [CrossRef] [PubMed]
4. Ma, Q.G.; Wang, X.Y. The Mathematic Description of the Individual and Crowd Behavior under Unconventional Emergency. *J. Ind. Eng. Eng. Manag.* **2009**, *137*, 834–855.
5. Dreyer, A.J.; Stephen, D.; Human, R.; Swanepoel, T.L.; Adams, L.; O'neill, A.; Thomas, K.G. Risky decision making under stressful conditions: Men and women with smaller cortisol elevations make riskier social and economic decisions. *Front. Psychol.* **2022**, *13*, 810031. [CrossRef]
6. Schmitz, F.; Kunina-Habenicht, O.; Hildebrandt, A.; Oberauer, K.; Wilhelm, O. Psychometrics of the Iowa and Berlin gambling tasks: Unresolved issues with reliability and validity for risk taking. *Assessment* **2020**, *27*, 232–245. [CrossRef]
7. Bell, R.P.; Towe, S.L.; Lalee, Z.; Huettel, S.A.; Meade, C.S. Neural sensitivity to risk in adults with co-occurring HIV infection and cocaine use disorder. *Cogn. Affect. Behav. Neurosci.* **2020**, *20*, 859–872. [CrossRef] [PubMed]
8. Hastie, R. Problems for Judgment and Decision Making. *Annu. Rev. Psychol.* **2001**, *52*, 653–683. [CrossRef]
9. Kahneman, D.; Tversky, A. Prospect Theory: An analysis of decision under risk. *Econometrica* **1979**, *47*, 263–291. [CrossRef]
10. Weber, E.U.; Blais, A.R.; Betz, N.E. A domain-specific risk -attitude scale: Measuring risk perceptions and risk behaviors. *J. Behav. Decis. Mak.* **2002**, *15*, 263–290. [CrossRef]
11. Blais, A.R.; Weber, E.U. A domain-specific risk-taking (DOSPERT) scale for adult population. *Judgm. Decis. Mak.* **2006**, *1*, 33–47. [CrossRef]

12. Jun, G.; Jie, W.; Xiao-Hong, G. Analysis of influencing factors of group decision making errors in unconventional Emergencies Based on SIM. *Saf. Secur.* **2018**, *9*, 11–14.
13. Vlaev, I.; Kusev, P.; Stewart, N.; Aldrovandi, S.; Chater, N. Domain effects and financial risk attitudes. *Risk Anal.* **2010**, *30*, 1374–1386. [CrossRef] [PubMed]
14. Angrisani, M.; Cipriani, M.; Guarino, A.; Kendall, R.; Zarate Pina, J.O. Risk Preferences at the Time of COVID-19: An Experiment with Professional Traders and Students. FRB of New York Staff Report No. 927. May 2020. Available online: https://ssrn.com/abstract=3609586 (accessed on 13 May 2020).
15. Ben, Z.; Breznitz, S. The effect of time pressure on risky on risky choice behavior. *Acta Psychol.* **1981**, *47*, 89–104.
16. Liu, X.G.; Yang, N.D. Research on Primacy Effect in Emergency Decision Making. *Chin. Saf. Sci.* **2013**, *23*, 170–176.
17. Dixon, G.; Aldao, A. Emotion regulation in context: Examining the spontaneous use of strategies across emotional intensity and type of emotion. *Personal. Individ. Differ.* **2015**, *86*, 271–276. [CrossRef]
18. Liu, D.H.; Peterson, T.; Vincenzi, D. Effect of time pressure and target uncertainty on human operator performace and workload for autonomous unmanned aerial system. *Int. J. Ind. Ergon.* **2016**, *51*, 52–58. [CrossRef]
19. Kirchler, M.; Andersson, D.; Bonn, C.; Johannesson, M.; Sørensen, E.; Stefan, M.; Tinghög, G.; Västfjäll, D. The effect of fast and slow decisions on risk taking. *J. Risk Uncertain.* **2017**, *54*, 37–59. [CrossRef]
20. Kocher, M.G.; Schindler, D. Risk, time pressure, and selection effects. *Exp. Econ.* **2019**, *22*, 216–246. [CrossRef]
21. El, H.A.; Krawczyk, M.; Sylwestrzak, M. Time pressure and risk taking in auctions: A field experiment. *J. Behav. Exp. Econ.* **2019**, *78*, 68–79.
22. Byrne, K.A.; Peters, C.; Willis, H.C.; Phan, D.; Cornwall, A.; Worthy, D.A. Acute stress enhances tolerance of uncertainty during decision-making. *Cognition* **2020**, *205*, 104448. [CrossRef] [PubMed]
23. Buckert, M.; Schwieren, C.; Kudielka, B.M.; Fiebach, C.J. Acute stress affects risk taking but not ambiguity aversion. *Front. Neurosci.-Switz.* **2014**, *8*, 82. [CrossRef]
24. Chen, J.L.; Li, Q.X.; Zhang, C.P. The experimental study on the influence of time pressure and decision maker's risk attitude on decision-making behavior in emergency. *Chin. J. Manag. Sci.* **2015**, *23*, 349–358.
25. Tanaka, T.; Camerer, C.F.; Nguyen, Q. Risk and time preferences; Linking experimental and household survey data from Vietnam. *Am. Econ. Rev.* **2010**, *100*, 557–571. [CrossRef]
26. Bartczak, A.; Chilton, S. Wildfires in Poland: The impact of risk preferences and loss aversion on environmental choices. *Ecol. Econ.* **2015**, *116*, 300–309. [CrossRef]
27. Lehman, B., III; Beach, L.R. The effects of time constraints on the prochoice screening of decision options. *Organ. Behav. Hum. Decis. Process.* **1996**, *67*, 222–228.
28. Li, S.; Liu, S.; Huang, P.; Liu, S.; Zhang, W.; Guo, X.; Liu, Z. The modulation of attentional deployment on regret: An event-related potential study. *Neuro Rep.* **2021**, *32*, 621–630. [CrossRef]
29. Liu, S.; Lu, Y.; Li, S.; Huang, P.; Li, L.; Liu, S.; Guo, X. Resting-state functional connectivity within orbitofrontal cortex and inferior frontal gyrus modulates the relationship between reflection level and risk-taking behavior in internet gaming disorder. *Brain Res. Bull.* **2022**, *178*, 49–56. [CrossRef]
30. Liu, Z.; Huang, P.; Gong, Y.; Wang, Y.; Wu, Y.; Wang, C.; Guo, X. Altered neural responses to missed chance contribute to the risk-taking behaviour in individuals with Internet gaming disorder. *Addict. Biol.* **2022**, *27*, e13124. [CrossRef]
31. Prelec, D. The Probability Weighting Function. *Econometrica* **1998**, *66*, 497–527. [CrossRef]
32. Mitroff, I.I.; Alpasan, M.C. Preparing for the evil. *Prep. Evil* **2003**, 5–11.
33. Liu, C.H. The Research of Response Strategies of Incidents of Supply Chain Strategies. Master's Thesis, Chang'an University, Xi'an, China, 2013.
34. Liu, E. Time to Change What to Sow: Risk Preferences and Technology Adoption Decisions of Cotton Farmers in China. *Rev. Econ. Stat.* **2013**, *95*, 1386–1403. [CrossRef]