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Consumers' Responsiveness towards Contaminated Imported Cold Chain Seafood in China: Does Trust Matter?

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Food contamination enhances consumer risk perceptions of food, erodes consumer trust in government food information, and alters actual consumer purchasing behavior. Imported cold chain seafood has been contaminated by novel coronavirus. However, not enough attention has been paid to economic studies of consumers purchasing imported cold-chain seafood contaminated with novel coronavirus. Given consumers' lack of trust in government information and the coexistence of food safety risk perceptions and their own risk preferences, we aimed to explore how Chinese consumers' trust in government information, consumers' perception of the food safety risk and their risk preferences affected consumers' actual purchasing behavior. This study is to examine the combined effects of consumers' trust in government information, risk perception, and risk preferences on actual purchasing behavior. In this study, 898 consumer questionnaires were collected online after an incident of contamination of imported cold-chain seafood, and a binary logit and OLS regression was used to estimate the relationship between trust in government information, risk perception, risk preference and actual purchasing behavior. The empirical results demonstrate that the interaction term between risk perception and risk preference positively affects actual behavior. Overall, trust in the government's information does not directly affect consumers' actual purchasing behavior. Interestingly, subgroup regressions reveal city heterogeneity in the effect of trust in government information on purchasing behavior.

Key words: Food contamination, Imported cold chain seafood, Purchasing, Risk perception, Risk preference, Trust in government information

INTRODUCTION

Data released by China's General Administration of Customs (GAC) demonstrate that China's seafood imports in 2023 reaches 5.02 million tons, and the cumulative import value is 19.78 billion USD. However, along with the growing scale of seafood trade, the problem of seafood contamination due to long cold chain storage time and poor preservation conditions has become increasingly prominent (Oliveira *et al.*, 2021), and has become a new issue affecting global food security (Dawson *et al.*, 2021). Imported cold chain seafood has been contaminated by novel coronavirus (Zhang *et al.*, 2022). In this context, consumers' purchase of imported cold-chained seafood is essentially a risky decision-making behavior under conditions of uncertainty (Yao *et al.*, 2017). Prospect theory suggests that risk decision-making behavior is affected not only risk preference and risk perception but also by the interaction between the two (Lusk and Coble, 2005; Petrolia, 2016).

Although, the Chinese government promptly took stringent measures and timely publicized safety information on imported cold chain seafood to consumers (Abbott *et al.*, 2021). Unfortunately, the occurrence of food safety incidents has led to a declining level of con-

sumer trust in food safety information issued by the government (Théolier *et al.*, 2021; Wang *et al.*, 2022), which ultimately leads to a distortion of the actual purchasing behavior of consumers (Huang, 2023).

Imported cold-chained seafood has the characteristics of "credence attributes". Thus, trust is a key factor influencing consumers' choice (Nuttavuthisit and Thøgersen, 2018; Carfora *et al.*, 2019; Yuan *et al.*, 2024; Troung *et al.*, 2021). French consumers' trust in producers and retailers positively affects their food purchase intentions (Ladwein and Romero, 2021). Trust in dairy farmers promotes Italian consumers' intention and behavior to purchase organic milk (Carfora *et al.*, 2019). Trust and mistrust in the food system are determinants of Vietnamese consumers' organic food choices (Troung *et al.*, 2021). In addition, trust in the country of organic food production was found to influence the choice of organic food through a study of consumers in Germany, France, Denmark, China and Thailand (Thøgersen *et al.*, 2019).

There is a gap between consumers' purchase intention and their actual purchasing behavior (Sultan *et al.*, 2020; ElHaffar *et al.*, 2020). This gap has been identified in many studies (Munro *et al.*, 2023; Dong *et al.*, 2022). More importantly, not enough attention has been paid to economic studies of consumers purchasing imported cold-chain seafood contaminated with novel coronavirus. Environmental research on imported cold chain seafood is becoming increasingly common (Dai *et al.*, 2023; Chen *et al.*, 2022). The roles of risk perception, risk preference, and trust in food choice have been

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widely explored (Mao *et al.*, 2023; Yuan *et al.*, 2024; Troung *et al.*, 2021; Roh *et al.*, 2022). However, incorporating the three variables of risk perception, risk preference, and trust in government information into the context of food contamination to explore their combined effects on consumer purchasing behavior remains unknown.

Therefore, to fill this gap, 898 consumer questionnaires were collected online after imported cold-chained seafood was contaminated, and empirical analyses are conducted using binary Logit and OLS regression. The study found that risk perception negatively affects consumers' actual purchasing behavior. Risk preference positively affects consumers' actual purchasing behavior. The interaction terms of risk perception and risk preference jointly affect actual purchasing behavior. Risk perception and risk preference do not differ significantly between high-risk and low-risk cities. However, trust in government information differs significantly between high and low risk cities. Interestingly, trust in government information does not directly affect consumers' actual purchasing behavior. Yet, in low-risk cities trust in government information directly affects consumer purchasing behavior, while in high-risk cities it does not directly affect consumer purchasing behavior.

THEORETICAL ANALYSIS AND RESEARCH HYPOTHESIS

The influence of risk perception, risk preference and the interaction on purchasing behavior

Consumers' risk decision-making behavior under uncertainty is a function of risk preference and risk perception. Risk preference refers to the basic attitude of consumers to food safety risks. Risk perception refers to consumers' subjective assessment of food safety risk probability based on their own experience.

Based on the Prospect Theory and Risk-return Theory, considering the consumer utility function $U(W)$, where W denotes income. These theories assume that consumers are risk averse. The consumer's expected value of the purchase of the target product is expressed as a random variable Z and $E(Z)=a$, a is a positive number, it indicates that the average impact of purchasing target products on revenue is positive. $Var(Z)=\sigma^2$, σ^2 is the variance of the random variable Z , which represents the consumer's risk perception, risk perception is positively correlated with σ^2 , the greater the risk perception, the greater the σ^2 . Define R as deterministic equivalence, that is, consumers believe that there is no difference between the utility of purchasing the target product and the utility of the deterministic currency received in the amount of R , indicating that R represents the monetary value of the consumer purchasing the target product. The larger R is, the more willing the consumer is to purchase the target product. Deterministic equivalence indicates that the following equations hold:

$$E[U(W+Z)]=U(W+E(Z)+R) \quad (1)$$

$U(\cdot)$ is the consumer utility function. Assuming that $E[Z]=0$, the utility function $U(W+Z)$ is second-order

continuous derivable. The second-order Taylor expansion of $U(W+Z)$ in the left side of Equation (1) at $[W+E(Z)]$ is obtained:

$$U(W+Z) \approx U[W+E(Z)] + U'[Z-E(Z)] + 0.5U''[Z-E(Z)]^2 \quad (2)$$

$$\text{In (2), } U' = \frac{\partial U}{\partial W}, U'' = \frac{\partial^2 U}{\partial W^2}$$

Taking the expected value of (2), we can derive the following equation:

$$E[U(W+Z)] \approx E[U[W+E(Z)]] + U'E[Z-E(Z)] + 0.5U''E\{[Z-E(Z)]^2\} \quad (3)$$

Because $E[Z-E(Z)]=0$, Therefore, Equation (1) can be expressed as:

$$E[U(W+Z)] \approx E[U[W+E(Z)]] + 0.5U''\sigma^2 \quad (4)$$

The first-order Taylor expansion of the right part of the equal sign of Equation (1) at $[W+E(Z)]$ can be obtained:

$$U[W+E(Z)-R] \approx U[W+E(Z)] - U'R \quad (5)$$

Combining Eq. (4) and Eq. (5), solving for R yields:

$$R \approx -0.5\sigma^2 \left[-\frac{U''(W)}{U'(W)} \right] \quad (6)$$

$$\text{In (6), } r(w) = -\frac{U''(W)}{U'(W)}, r(w) \text{ is the absolute risk}$$

aversion coefficient of Arrow-Pratt, which is used to measure the degree of risk preference of consumers. The increase of $r(w)$ indicates that the degree of risk aversion of consumers increases. Since R represents the monetary value of the consumer's consumption of the target product, Equation (6) shows that the consumption value of the target product decreases with σ^2 and $r(w)$. σ^2 represents the risk perception of the target product. Risk perception enhances the decline in the consumption value of the target product, so the possibility of purchasing the target product decreases. The increase of $r(w)$ indicates that the consumption value of the target product decreases and the possibility of purchasing the target product decreases. The Arrow-Pratt framework states that consumer behavior is not only affected by risk perception and risk preference, but also by the interaction between the two. This interaction suggests that when consumers perceive less risk, consumers with risk preference are more likely to adopt risk behavior. Based on this, research hypothesis 1, 2, 3 is proposed.

- H1: Risk perception negatively affects the purchasing of imported cold chain seafood.
- H2: Risk preference positively effects the purchasing of imported cold chain seafood.
- H3: The interaction terms of risk perception and risk preference jointly influence purchasing.

The direct effect of trust in government information on purchasing behavior

Trust is a form of stable belief, is the performance of the dependent relationship, the higher the degree of trust, the more consumers implement positive behavior. Contamination of imported cold-chain seafood increases

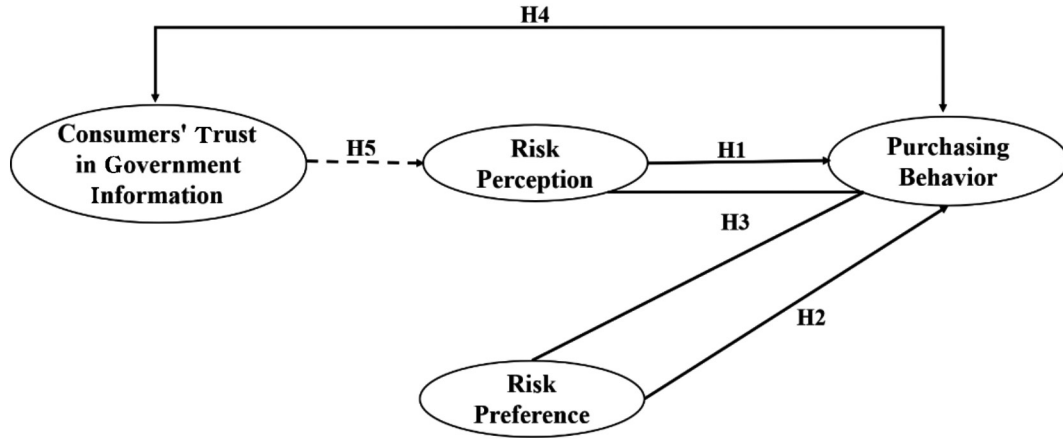


Fig. 1. A theoretical analytical framework.

consumer uncertainty about its safety and reduces their sense of control. Hence, consumers want to compensate for the lack of control and assess the potential negative impact of imported cold chain seafood safety risks on themselves and their families from the food information provided by the government, and provide a basis for their behavioral decision-making (Huang *et al.*, 2019). When consumers trust the food information provided by the government, they will promote the purchasing behavior, otherwise they will inhibit the purchasing behavior. Based on this, this paper proposes research hypothesis H4.

H4: Trust in government information will directly affect consumers' purchasing of imported cold chain seafood.

The indirect effect of trust in government information on purchasing behavior: the mediating role of risk perception

The higher the degree of trust in government information, which means that consumers' subjective expectations of the probability of occurrence of adverse consequences or the degree of fear of adverse consequences are reduced (Quan *et al.*, 2011). The lower the consumer's risk perception (Zhu and He, 2021). As the degree of trust in government information increases, the degree of consumer risk perception decreases. Based on this, the research hypothesis H5 is proposed.

H5: Trust in government information negatively affects risk perception, it indirectly affects the purchasing behavior through risk perception.

Based on the above theoretical analysis, this paper constructs a theoretical analysis framework for consumers' purchase of imported cold-chain seafood, as shown in Fig. 1.

MATERIALS AND METHODS

Methods

The influence of risk perception, risk preference and the interaction on purchasing behavior (H1, H2, H3)

This paper adopts the logit model for regression, and the expression is as follows:

$$P_i = F(y) = \frac{1}{1 + e^{-y}} \quad (7)$$

In equation (7), P_i is the probability that a consumer purchases imported cold-chained seafood. y indicates imported cold-chain seafood consumption behavior. $y=1$, indicating that consumers have purchased imported cold-chained seafood. $y=0$, indicating that consumers did not purchase imported cold-chained seafood. y is a linear combination of the variables *Risk*, *Preference*, *Risk*Preference*, *Control*.

$$y = \beta_0 + \beta_1 Risk + \beta_2 Preference + \beta_3 Risk*Preference + \beta_4 Control + \varepsilon \quad (8)$$

In equation (8), *Risk* is the consumer's perceived food safety risk of imported cold-chained seafood. *Preference* is the consumer's level of risk preference. *Control* is a control variable. This paper introduces control variables such as age, gender, education level, family monthly income, imported cold chain seafood prices, consumption habits, safety of imported cold-chained seafood, different cities (low-risk and high-risk cities). ε is the random disturbance term.

Equation (7) and (8) are processed to obtain the expression of the binary logit model as follows.

$$\ln \frac{P_i}{1-P_i} = \beta_0 + \beta_1 Risk + \beta_2 Preference + \beta_3 Risk*Preference + \beta_4 Control + \varepsilon \quad (9)$$

The direct impact of trust in government information on purchasing behavior (H4)

Trust in government information was added to estimate its direct effect on purchasing behavior.

$$\ln \frac{P_i}{1-P_i} = \beta_0 + \beta_1 Risk + \beta_2 Preference + \beta_3 Trust + \beta_4 Control + \varepsilon \quad (10)$$

In equation (10), *Trust* is the degree of trust in government information. *Risk*, *Preference*, *Control*, ε are the same as equation (9).

The indirect impact of trust in government information on purchasing behavior (H5)

Referring to Wen *et al.*, (2014), OLS regression was used to assess the indirect effect of trust in government information.

$$Y = cTrust + \gamma_0 Control + e_1 \quad (11)$$

$$Risk = aTrust + \gamma_0 Control + e_2 \quad (12)$$

$$Y = c'Trust + bRisk + \gamma_0 Control + e_3 \quad (13)$$

Y is the same as equation (7). e_1, e_2, e_3 is the residual term. *Trust, Risk, Preference, Control* are the same as equation (9). When the regression coefficient c is significant, and at least one of a and b is not significant, it is necessary to further test the significance of the product of regression coefficients. When it is not significant, it indicates that the indirect effect is not significant. When it is significant, it indicates that there is a “mediating effect”.

Data

The data is based on an online questionnaire issued from December 13, 2022 to December 31, 2022. This study covers Beijing, Shanghai, Wuhan, Qingdao, Dalian, Jinzhou, Yantai, Weifang, Yangzhou, Linyi, Nanjing, Suzhou. We code as 1 if it is one of Shanghai, Beijing, Wuhan, Dalian, Qingdao, and other cities (such as Jinzhou, Yantai, Nanjing, Suzhou) coded as 0. This is due to the fact that between June and November 2022, imported cold chain seafood was contaminated in five cities (Shanghai, Beijing, Wuhan, Qingdao, Dalian), but not in the other cities. Therefore, this paper defines

these five cities as high-risk cities and the other cities as low-risk cities. A total of 898 questionnaires are collected in the online survey, and 868 valid questionnaires are obtained by excluding invalid questionnaires such as respondents have never consumed imported cold chain seafood, missing key core information, and inconsistencies. The basic characteristics of the sample are shown in Table 1.

Variable

Regarding the variable *Purchasing behavior*, consumers were asked “Have you purchased imported cold-chained seafood after it was contaminated?” to measure purchasing behavior. Yes=1, No=0.

Regarding the variable *Trust*, the question “Do you trust the information published by the government on the safety of imported cold chain seafood?” to measures the degree of trust in government information (Chen and Zhong, 2021). Strongly distrust=1, Distrust=2, Neutral=3, Trust=4, Strongly trust=5.

Regarding the variable *Risk*, the question “Do you agree there is a great food safety risk in the imported cold chain seafood on the market?” to measure risk perception (Brown and Nguyenviet, 2022). Strongly disagree=1, Disagree=2, Neutral=3, Agree=4, Strongly

Table 1. Basic characteristics of the sample

		Number	%
Gender	Male	362	41.71
	Female	506	58.29
Age	Under 30	239	27.53
	30–40	295	33.99
	41–50	191	22.00
	51–60	105	12.10
	Over 60	38	4.38
Education Level	Primary and below	9	1.04
	Junior high school	79	9.10
	High school or secondary school	116	13.36
	Undergraduate or college	447	51.50
	Master degree or above	217	25.00
Monthly household	Under 5000	167	19.24
	5000–10000	346	39.86
	10000–20000	229	26.38
	20000–30000	72	8.29
	Over 30000	54	6.22
Region	City	580	66.82
	Rural	288	33.18
City	Beijing	44	6.71
	Wuhan	118	17.99
	Qingdao	191	29.12
	Dalian	139	21.19
	Shanghai	164	25.00

Table 2. Descriptive statistics

	Variable Meaning	Mean	Standard Deviation
<i>Purchasing behavior</i>	Purchase or not	0.21	0.41
<i>Trust</i>	Degree of trust in government information	3.43	0.92
<i>Risk</i>	Degree of risk perception	3.32	1.27
<i>Preference</i>	Degree of risk preference	1.76	1.01

Table 3. Logit regression results

	Equation (9) Purchasing behavior	Equation (10) Purchasing behavior
<i>Trust</i>	–	0.180 (1.55)
<i>Risk</i>	–0.360** (1.98)	–0.328* (–3.85)
<i>Preference</i>	0.700*** (2.99)	0.293*** (2.90)
<i>Risk*Preference</i>	–0.170** (–1.88)	–
<i>Control variable</i>	Yes	Yes
<i>Constant</i>	–3.08*** (–3.08)	–8.769 (–7.54)
N	868	868
LR Chi	239.05	232.83
Pseudo R ²	0.2513	0.2589
Log Likelihood	–356.122	–333.280

Note: ***indicates statistical significance at the 1% level, **at the 5% level, and * at the 10% respectively. N=868.

Table 4. OLS regression results

	Equation (11) Purchasing behavior	Equation (12) Risk	Equation (13) Purchasing behavior
<i>Trust</i>	0.025* (1.83)	–0.072 (–1.64)	0.022 (1.61)
<i>Risk</i>	–	–	–0.043*** (–4.09)
<i>Control variable</i>	Yes	Yes	Yes
<i>Constant</i>	–0.670*** (–5.73)	3.676*** (9.80)	–5.112*** (–4.18)
N	868	868	868
R ²	0.2109	0.1472	0.2261
F value	20.80	14.60	20.82
P value	0.0000	0.0000	0.0000

Note: ***indicates statistical significance at the 1% level, **at the 5% level, and * at the 10% respectively. N=868.

agree=5.

Regarding the variable *Preference*, the question “I do not consider food safety risk when consuming imported cold chain seafood” to reflect risk preference (Chen and Zhong, 2021). Strongly disagree=1, Disagree=2, Neutral=3, Agree=4, Strongly agree=5. Variable meaning and descriptive statistics are shown in Table 2.

RESULTS

The influence of risk perception, risk preference and the interaction on purchasing behavior (H1, H2, H3)

Risk perception has a significant negative impact on

purchasing behavior. When other conditions remain unchanged, the stronger the consumer's risk perception of the food safety risk, the less likely the purchasing behavior is (Table 3). Hypothesis H1 has been verified.

Risk preference has a significant positive impact on consumer purchasing behavior. In the case of other conditions unchanged, the more likely consumers with a preference for risk are to purchase (Table 3). Hypothesis H2 has been verified.

The interaction coefficient is significantly negative. The regression coefficients for risk perception are also significantly negative, and both coefficients have the same sign, indicating that risk preference reinforces risk perception, suggesting that consumers who are more risk-preferring are more likely to purchase, given the

Table 5. City grouping regression results

	(1) High-risk cities	(2) Low-risk cities	(3) Suset Test
<i>Trust</i>	0.184 (1.52)	0.739** (2.30)	0.086*
<i>Risk</i>	-0.645*** (-6.23)	-0.961*** (-3.80)	0.162
<i>Preference</i>	0.261*** (2.76)	0.435** (1.90)	0.477
<i>Control variable</i>	Yes	Yes	Yes
<i>Constant</i>	-2.226** (-2.10)	-1.764*** (-0.93)	0.831
N	656	212	–
LR Chi	180.99	71.87	–
Pseudo R ²	0.2439	0.3500	–
Log Likelihood	-280.577	-66.736	–

Note: ***indicates statistical significance at the 1% level, **at the 5% level, and * at the 10% respectively. N=868.

same risk perception (Table 3). Hypothesis H3 has been verified.

The direct effect of government information trust on purchasing behavior (H4)

Trust in government information did not have a direct effect on purchasing behavior (Table 3). Hypothesis H4 has not been tested.

The indirect impact of government information trust on purchasing behavior (H5)

Trust in government information has no impact on risk perception (Table 4), indicating that the indirect effect is not significant. Hypothesis H5 has not been confirmed.

Heterogeneity analysis

This paper further analyzes the impact of these variables on consumers' actual purchasing behavior from the perspective of city heterogeneity.

There is no significant difference in risk perception and risk preference between consumers in high-risk and low-risk cities. Risk perceptions of consumers in both high-risk and low-risk cities have a negative impact on purchasing behavior, while risk preferences have a positive impact on purchasing behavior (Table 5).

However, there is a significant difference in consumers' trust in government information between high-risk and low-risk cities. Consumers' trust in government information in low-risk cities has a significant positive effect on purchasing behavior. The larger coefficients for low-risk cities compared to high-risk cities indicate that trust in government information in low-risk cities has a stronger positive effect on purchasing behavior (Table 5).

DISCUSSION

Risk perception is a key factor preventing consumers from purchasing contaminated imported cold-chain seafood. The more likely consumers with a preference for risk are to purchase imported cold-chained seafood

contaminated. The interaction term between risk perception and risk preference has an impact on consumer purchasing behavior. This result is consistent with (Lusk and Coble, 2005; Petrolia, 2016).

Trust in government information does not directly affect consumers' food purchasing behavior. The possible reason is that one is the consumer's own risk aversion. Most consumers are risk averse (Wan *et al.*, 2023). The survey data in this paper suggests that 79.27% of consumers avoid doing risky things. Second, the rapid spread of online rumors has intensified its risk perception. Therefore, the degree of trust in government information has no direct effect on purchasing behavior.

Finally, the study finds that there is city heterogeneity in the impact of trust in government information on consumers' food purchasing behavior. Specifically, trust in government information significantly positively promotes consumers' food purchasing behavior in low-risk cities, but does not directly affect consumers' food purchasing behavior in high-risk cities.

CONCLUSIONS

Previous studies have extensively examined the effects of two factors risk perception and risk preference on food purchasing behavior. This paper incorporates trust in government information, risk perception, and risk preference into the context of food contamination to analyze their combined effects on consumer purchasing behavior. Data were collected from 898 Chinese consumers and the results were evaluated using binary logit model and OLS regression.

Risk perception remains a major driver of consumer food purchasing behavior. Risk preference positively influences consumers' purchasing behavior; the more risk-preferring consumers are, the more likely they are to purchase. The interaction term of risk perception and risk preference had a joint effect on purchasing behavior. Risk perception and risk preference do not differ significantly between high-risk and low-risk cities.

Trust in government information differs significantly between high and low risk cities. Trust in government

information had no direct effect on consumer purchasing behavior. It has no direct effect on risk perception, it has no indirect effect on consumer purchasing behavior. However, in low-risk cities, it has a significant direct effect on purchasing behavior, while in high-risk cities it has no direct effect on purchasing behavior.

AUTHOR CONTRIBUTIONS

Sha Huang analyzed the data, and drafted the manuscript (the contributions account for 30%); Tinggui Chen collected the data, supervised the research and made critical revisions to the manuscript (the contributions account for 30%); Yoshifumi Takahashi drafted the manuscript (the contributions account for 20%), and Mitsuyasu Yabe supervised the research and made critical revisions to the manuscript (the contributions account for 20%).

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