SUSTAINABLE MARKET ENVIRONMENT AND CONSUMER CONFIDENCE IN FOOD SAFETY IN CHINA AFTER COVID-19: URBAN CONSUMER PERSPECTIVES

Hasnain Abbas[1]
Hafeez Ullah[2]
Xi Gong[3]
Mengyin Jiang[4]
Narmeen Faiz[5]
Lindu Zhao[+6]

[1,3,4,5,6]*School of Economics and Management, Southeast University, China.*
[1]*Email: hasnainabbas354@yahoo.com Tel: +86-18851736278*
[3]*Email: 1369113780@qq.com Tel: +86-1369113780*
[4]*Email: jiangmengyin@naver.com Tel: +86-18651832821*
[5]*Email: narmeenfaiz391@gmail.com Tel: +92-3146602077*
[6]*Email: ldzhao@seu.edu.cn Tel: +8625-83792323*
[2]*Antai College of Economics and Management, Shanghai Jiao Tong University, China.*
[2]*Email: hafeez.2017@hotmail.com Tel: +86-15684700221*

(+ Corresponding author)

ABSTRACT

Previously, several food safety incidents have lowered Chinese consumer confidence regarding the purchase of meat and domestically-produced infant formulas (DIF). Recently, the COVID-19 pandemic was caused by a food safety issue, and it is, therefore, important to investigate sustainable consumer confidence and its influence on consumption behavior by first estimating consumer confidence in meat and DIF products. The purpose of this study is thus to estimate the sustainable market environment and Chinese consumer confidence behavior post-COVID-19 regarding the purchase of meat and DIF products by applying a choice experiment. An online survey was conducted with 704 consumers residing in Nanjing. The survey obtained information on the features of meat and DIF products that affected consumer purchase consideration and determined the perceived estimated value of the product (price 15.24%, quality certification 31.57%, organic 23.69%, traceability 18.51%). These findings provide insight into consumer perceived premium pay behavior concerning the value estimation of product features according to the market environment (price 191.6 CNY, quality certification 285.3 CNY, organic product 189.1 CNY, and traceability 143.7 CNY). Chinese consumers' low confidence in the safety of meat and DIF products appears less sustainable. Quality certification is the product feature that is most valued, followed by organic origin and production-to-consumption traceability. Apart from these, price is seen as an indication of high quality by consumers with low confidence, which results in a positive image of DIF products. In addition, consumer preferences for production-to-consumption traceability are highly affected by consumer confidence.

Contribution/Originality: This study contributes to the existing literature on food safety incidents and the measurement of consumer confidence levels toward infant formula products in the market.

1. INTRODUCTION

Currently, food safety assurance is achieved through consumers' willingness to demand high-quality food with information transparency and safety promises (Meixner & Katt, 2020; Tao, Iftekhar, Cai, & Cui, 2021). Food traceability networks achieve safety governance across geographical boundaries, encouraging consumer confidence in food safety and decreasing information asymmetry in sustainable agricultural development (Dzwolak, 2016; Wentholt, Rowe, König, Marvin, & Frewer, 2009). Food traceability networks are widely implemented and play an important role in sustaining food safety confidence in developed countries (Pizzuti & Mirabelli, 2015).

Since the 1990s, food safety problems have repeatedly damaged the confidence of Chinese consumers. Actually, the whole world faces a common problem with food safety risks. Globally, consumers face many different food safety risks. Every year, approximately 2.2 million deaths caused by foodborne toxins or watery diarrhea are recorded globally, according to the World Health Organization (WHO) (Todd, 2017). In the United States, prior to 1999, approximately 5000 people died from foodborne diseases each year (Tauxe, 2019). Often, consumers cannot immediately and exactly connect their disease to a certain food that has damaged their health. The information asymmetry in food safety arises because consumers cannot observe the production process (Djokoto & Gidiglo, 2016). Food traceability networks are an effective means of increasing transparency in food production and distribution by creating a continuous trusted flow of safety information through the supply chain ensuring traceability in the case of product recalls and allowing the source of the problem to be identified (Accorsi, Ferrari, Gamberi, Manzini, & Regattieri, 2016). Therefore, traceability networks are considered the main tool to effectively eliminate information asymmetry and provide a fundamental means of mitigating food safety risks (Frewer, Van Dijk, & Fischer, 2010).

Consumers take action to minimize food risks (Jenkins-Smith & Kunreuther, 2001), for instance, by substituting imported products for domestic products. Moreover, the online market in China is growing rapidly – it is estimated that the online market reached its highest point in 2019 (Kim, 2020). Because e-commerce is increasingly popular among Chinese consumers, conditions are favorable for Chinese consumers to access imported dairy products. To indicate quality and safety, countries use source labeling, which influences consumer food choices, preferences, and purchase decisions (Costanigro, Deselnicu, & Kroll, 2015; Hussein & Fraser, 2018; Mohsin, Ullah, Iqbal, Iqbal, & Taghizadeh-Hesary, 2021).

In consumer studies, health and nutrition declarations are commonly included in foods' labeling standards, which consist of details on the nutritional utility and health performance of food products (Aldakhil, Nassani, Abro, & Zaman, 2018; Kuester & Vila, 2017; Schnettler et al., 2019). Similarly, the functional foods business is a multibillion-dollar market that includes a large variety of foods, making it difficult for any study to reach standard results without accounting for the huge variances between particular varieties of food (Siegrist & Hartmann, 2020; Wu & Wang, 2021). Consequently, a specific subsection of functional food, the functional refined meat section, and a characteristic product, specifically pork sausages, were the focus of this study. Refined meat products represent a substantial portion of the routine expenditure of numerous consumers and are a steadily progressing industry in China (Bindu, Ravishankar, & Gopal, 2012). Moreover, they are mostly connected to negative health consequences and have been declared harmful to humans (Tobin, O'Sullivan, Hamill, & Kerry, 2014).

To understand willingness-to-pay (WTP), studies have investigated consumer behaviors, attitudes, and readiness to pay for safer, certified fresh food. Previous studies have described consumers' willingness to pay higher prices for food of certified safety and quality standards. Studies have revealed that gender, income, age, education, cultural and regional differences, and behavior regarding certified traceability channels are factors that influence consumer WTP a price surcharge for certified food (Ezeudu, Agunwamba, Ezeudu, Ugochukwu, & Ezeasor, 2021). Thus, Chinese respondents were willing to pay a US$22.0 surcharge per year to purchase certified organic milk (Wann, Yang, & Huang, 2016).

This paper fills the gap in the empirical literature by evaluating the effects of consumer confidence and perceived value on the sustainable market environment in urban China, a subject that is currently lacking in the literature. Importantly, this study estimates consumer confidence behavior and perceived product value by evaluating product purchase decisions based on product features that derive from the implementation of a product traceability system, such as additive information labels and third-party certification, as well as the economic benefits derived from the current certification system policy. The results from this study can be considered to determine market product price trends and the sustainable market environment of these products by indicating consumer demand and premium pay behavior.

2. THEORETICAL BACKGROUND

Previous empirical studies have explained Chinese consumers' perceptions and preferences regarding food quality and associated certifications, encompassing product safety, organic production, and geographical sources (Mumtaz, Hussain, Baqar, Anwar, & Bilal, 2021; Shukla & Iyengar, 2014; Wilson & Lusk, 2020). Taking pork products as the focus of their study, a consumer survey among seven cities in China found that consumers were willing to pay the highest surcharge for governmental safety affirmation (Wang, Zhang, Ortega, & Olynk Widmar, 2013). This confirmed the attractiveness of certifications distributed by a formal authority (Hou, Wu, & Chen, 2019; Ullah, Wang, Abbas, Zhang, & Shahzad, 2021). Although nutrition and health requirements are necessary attributes that are firmly related to the primary attributes of functional food products, studies have shown that this fact does not weigh as heavily with Chinese consumers (Kucher, Hełdak, Kucher, & Raszka, 2019). Another study focused on dairy products. The scholars surveyed Shanghai consumers about their preference for imported milk with nutritional additives and concluded that Chinese consumers are willing to pay premium prices for milk that promises additional nutrition in the form of vitamins or minerals, and the country of origin is another controlling element in "preferences production" (Luckemeyer, Miller, Kerth, & Adhikari, 2016). Similarly, Austrian beef is perceived as of higher value and demands a higher price than Chinese or US beef, and Chinese consumers especially value information on factors that increase food safety. In another study, the same authors investigated the significance of food safety promises by researching frozen pork; they suggested that consumers in mainland China value pork from their own country above that from the US, but their preference is reversed when the US pork has a food safety mark (Li, Chavas, Etienne, & Li, 2017).

However, the opposite was found in studies of dairy products and wines (Sadiq, Hsu, Zhang, & Chien, 2021). Nevertheless, despite the varied outcomes, a common conclusion is that Chinese consumers prefer food like pork to come from China, particularly as no foreign food status or product recognition is effectively encouraged in the local market. A large number of studies have described an expansion in the organic food market based on changes in consumers' behavior, attitudes, concerns, and readiness to pay for organic food, all of which directly affect the organic market (Abbas, Wang, Bashir, Iqbal, & Ullah, 2021; Arce Salazar & Oerlemans, 2016; Hamann, 2016). The price premium, the surcharge paid above and beyond the unbiased price that is justified by the original value of the product, is a function of consumers' demand for the products (Hamzaoui Essoussi & Linton, 2010). Accordingly, the organic food demand can be measured by the willingness-to-pay (WTP) for organic products (Janssen & Hamm, 2012). Factors affecting consumers' WTP premium prices for organic products have been widely investigated. Gender, income, age, education, regional and cultural differences, and behaviors regarding certified traceability networks are factors that influence consumers' WTP a price premium for certified products (Usmani et al., 2022). Similarly, considerations regarding food safety have an important effect on consumers' WTP price premiums (Nilsson, Foster, & Lusk, 2006). For instance, farm size has been shown to impact consumers' WTP for milk products (García-Íñiguez de Ciriano et al., 2010). Moreover, in a survey of consumers in China that took soymilk as an example, consumers were willing to pay extra for organic attributes (Byrd, Widmar, & Gramig, 2018).

Various research methods have been applied to examine consumers' WTP for premium organic food. Several studies have constructed choice assessments to obtain WTP values from participants (Güney & Giraldo, 2019). Choice assessments ask participants to select between products rather than rating or ranking them, a method that probably simulates actual purchasing circumstances more exactly (Parry & Kawakami, 2015). On the other hand, some researchers insist that choice analysis contributes many hypothetical purchasing situations that may lead to hypothetical bias (Whitehead, Weddell, & Groothuis, 2016). Consequently, to analyze consumers' WTP a combination of sensory evaluation and experimental actions has been applied (Yadav, Luthra, & Garg, 2021). Moreover, other methodologies, such as binary probity analysis (Torres & Marshall, 2018) and the interval regression method have also been applied. The theory of Lancaster states that consumer satisfaction is determined by product attributes instead of the product itself. Consumer satisfaction is based on information attributes (Nelson, 1974; Wunderlich, Gatto, & Smoller, 2018). Therefore, including traceability in product information can contribute to

increasing the promise of quality if traceability information characteristics from food traceability networks are integrated with other attributes, including quality inspection, environmental effect, animal welfare, and origin certifications (Galliano & Orozco, 2011).

Crucially, food quality and food safety are not equal. Globally, as food safety incidents occur on a large scale, consumers anticipate that food quality and safety can be guaranteed through their purchasing choices, and they consequently prefer food with certification information, traceability, and quality assurance (Isaak & Lentz, 2020; Vecchio & Annunziata, 2015). Thus, this study analyzes consumer choices and willingness to pay premium prices for traceability information, using hypothetical analysis. The expectation is that consumers are likely to pay extra for food with traceability information (Wang et al., 2020; Yontar & Ersöz, 2021).

3. METHOD

3.1. Survey and Sample

In this study, the data taken were collected through an online survey carried out in May 2021 in the city of Nanjing, which is situated in the Jiangsu Province Industrial Circle, one of the biggest accumulations of cities in China. Nanjing is the most developed city in China; per capita disposable incomes in urban households reached 159,082 and 125,500 CNY, respectively. Among the urban citizens with comparatively large income standards in this region are many consumers of imported infant formulas (Lakner et al., 2021). After the melamine-adulterated infant formula event occurred in the Shijiazhuang area of Hebei province in 2008, consumer confidence in the nearby cities fell dramatically, which shows that consumers living in cities are the most appropriate citizens to survey at the crucial time. Recently, the Covid-19 pandemic, which was caused by a food safety issue, lowered consumer confidence again.

3.2. Estimating Consumer Confidence

To assess Chinese consumer confidence in the safety of meat and DIF products, we constructed a suitable scale using principal component analysis (PCA) and legitimized it using confirmatory factor analysis (CFA). Some of the 25 questions answered by respondents to assess consumer confidence about food safety were acquired from the research of De Jonge, Van Trijp, Goddard, and Frewer (2008), with adjustments made to apply specifically to meat and DIF products. Certain items assessed consumers' perception of meat and DIF products' safety, their choices and preferences connected to utilization, as well as their liking and disliking behaviors regarding the safety of meat and DIF products (Grubor, Milicevic, & Djokic, 2018; Abbas et al., 2022). Every item was measured on a 5-point Likert scale from (1) strongly disagree to (5) strongly agree. To check the accuracy of the measurement scale, the data were randomly divided among separate items. In the PCA, varimax rotation was initially supervised to investigate the fundamental measure design of 25 samples constructed on the scale. To measure whether this standard achieves a good fit with other independent items, the more precise CFA was adapted to the items to maximize possible accuracy. After three samples were eliminated that diverged notably from what was anticipated depending on the sample feedings, an accurate measurement with 9 items was selected to estimate consumer confidence about the safety of meat and DIF products. Consequently, estimating consumer confidence and choices made regarding the safety and quality of DIF products and meat after the Covid-19 pandemic in this region is useful for local dairy companies and meat producers to implement efficient market strategies while engaging with global organizations. This research selected consumers who were buyers of meat and DIF products; all respondents were selected online through the WeChat social network.

Figure 1 Before the complete questionnaire was circulated, a trial experimental questionnaire was sent out to 25 participants, who were randomly selected in Nanjing, to produce a structure to develop the survey layout, particularly to manage the attributes and their related volumes in the selection assessment. In this research, we surveyed 704 participants randomly from around downtown Nanjing, applying a stratified multistage sampling technique. All locations in this city were determined anonymously; in every selected region, consumers were chosen according to a

primary random technique, by asking who would like to take part in the survey. Our questionnaire was based on three areas of factors: participants' socio-demographic characteristics, consumer confidence in meat and DIF food safety, and preference-examining questions on meat and DIF products with attributes pertaining to price, origin, organic source, production-to-consumption traceability, and quality certification.
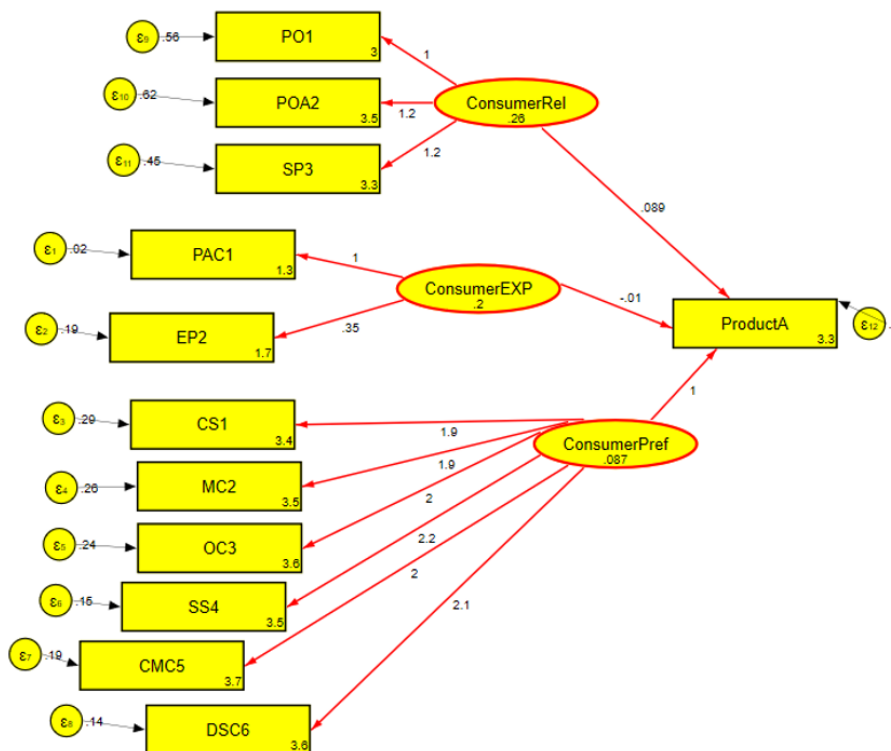

Figure 1. Graphical hypothesis measurement model.

3.3. Choice Experiment Product Features

The choice experiment method was used to investigate consumers' attitudes and their willingness to pay premium prices for quality and safety features of meat and DIF products. For the experimental analysis, four features were selected: price, organic foods, production-to-consumption traceability, and quality certification.

Price: There are considerable differences in the prices of Meat and DIF products in the market due to various weight identifications, which range from 300 to 1200 g. To avoid uncertainty, we selected "1200 g of Meat and DIF products for youth aged between 13 and 35 years" as the characteristic outcomes in the selected measurement. The factor *"Price"* varies depending on the actual market prices of meat and infant formulas and the actual consumer willingness to pay, with prices of 50, 80, 150, 180, and 200 for meat, and 100, 200, 330, and 550 for DIFs "CNY for 600 g". Accordingly, we developed a fractional factorial orthogonal structure to produce 10 survey reports employing STATA 16. Each report contains 8 functions and each function consists of two product descriptions and no choice.

Organic: Following the 2008 incident, organic milk production rose to meet the increasing need for secure DIF products in China. Therefore, it is necessary to measure Chinese consumers' estimation of organic DIF products and whether they prefer this characteristic to avoid potential hazardous DIF products due to the loss of confidence. The feature *"Organic"* considers two values: "organic" and "non-organic".

Production-to-consumption traceability: The traceability networks have been developed to enhance food safety and consumer confidence in advanced economies (Loureiro & Umberger, 2007; Williamson, 2018). Inspired by important consumer observations on the safety of meat and DIF products, different Chinese dairy organizations have built internal traceability networks. In this survey, the traceability feature *"Traceability"*, which allows the values "yes" or

"no", permits us to measure consumers' estimation of traceability data concerning the manufacturing process of meat and DIF products.

Quality certification: This certification informs consumers regarding the safety of the food products they want to purchase. Accordingly, consumers prefer to acquire more detailed quality assurances, such as certification by third-party organizations (Lazar & Chithra, 2021; Wang & Liu, 2013). The quality certification feature has two values, "yes" and "no", and consequently permits us to determine the level of quality certification consumers prefer.

3.4. Simulation Models

A mixed logit model was used to examine data from the selection assessment, concerning the number of objectives. A mixed logit model permits for heterogeneity in perceptions that are separated into recognized characteristics (Hole & Kolstad, 2011). One interesting quality of the mixed logit model is that it requires but does not suppose the separation of unrelated choices; consequently, this is considered a more reasonable model design than the standard logit model (Abbas et al., 2021; Yu, 2010). Moreover, it has been shown that certain discrete choice random utility models are feasibly estimated by a properly identified mixed logit model (Abbas, Zhao, Gong, Jiang, & Faiz, 2022; Kertesz, 2017). Consumers are expected to select a feature collection of meat and DIF products based on their budget. The satisfaction of consumer s selecting product d among J choices of meat and DIF products is represented as:

$$U_{sd} = X'_{sd}\beta_s + \xi_{sd} + \varepsilon_{sd} \tag{1}$$

Where X_{sd} is the sequence of the four product features explained above, ξ_{sdt} denotes undiscovered product features, and ε_{sd} is an individually and equivalently distributed $(s.s.d.)$ disruption interval.

To investigate possible heterogeneity in consumers' answers to questions on meat and DIF product features due to varying levels of consumer confidence, it is additionally necessary to identify the set of casual coefficients β_s to add an arranged unit (β) and a variable element that differs according to consumers' levels of liking $(like_s)$ and disliking $(dislike_s)$, in addition to other characteristics (δ_s), such as sociodemographic and unobserved characteristics:

$$\beta_s = \overline{\beta} + \lambda_1 like_s + \lambda_2 dislike_s + k\delta_s \tag{2}$$

Where the factors λ_1 and λ_2 denote how consumers' choices differ with varying levels of positive and negative perception, respectively; δ_s follows a multifactor normal distribution with κ as a proportion sequence.

As the point of satisfaction increases, a consumer selects choice d if, and only if, his or her benefit relating to this is significantly higher than that achieved by any other option. The likelihood of consumer s selecting option d is then the fundamental of standard logit likelihoods over the factor weights:

$$Prob_{sd} = \int \frac{exp(X'_{sd}\beta_s)}{\sum_{r=1}^{J} exp(X'_{sr}\beta_s)} f(\delta_s)c\delta_s \tag{3}$$

The related log probability is stated by:

$$L = \sum_{s=1}^{I} \sum_{d=1}^{J} c_{sd} \ln Prob_{sd} \tag{4}$$

Where $C_{sd} = 1$ if consumer s selects option d and zero otherwise; $Prob_{sd}$ is explained in Equation 3. A simulated highest probability measurement technique with 500 Halton draws was implemented to measure the factors in Equations 3 − 4. Moreover, to investigate how consumers' willingness to pay a premium for DIF products might differ according to their level of confidence, the mixed logit model precisely measures this in terms of extra pay for volume, through the relationships expressed among the product features and the two confidence estimates. Analyzed using the regular technique of measuring premium payments (Wang, Mao, & Gale, 2008), the model used to declare the extra cost has two benefits. First, it allows the choice of price to be heterogeneous and may, therefore, result in more accurate extra cost estimates (Danthurebandara, Yu, & Vandebroek, 2011; Touri, 2020). Secondly, it measures the extra cost to consumers precisely. To achieve this, it prevents the random selection of the premium cost distribution, which, taken as the partition of the coefficients of the non-quantifiable features along with the coefficient

of price, might point to uncommon distributions of extra cost principles. More explicitly, it advances Equation 1 as a function of price, *price s*, and includes other product features:

$$\overline{X}_{sd}.U_{sd} = \beta_s^{price} Price_s + \overline{X}_{sd}\beta_s + \xi_{sd} + \varepsilon_{sd} \tag{5}$$

Where β_s *price* and β_s are separate particular factors for price and other product attributes, respectively. The findings within a mixed logit model describe the level of preference when the premium cost is determined by non-quantifiable features. This leads us to additionally develop Equation 5 as:

$$U_{sd} = \beta_s^{price} \left[price_s + \gamma_s \overline{X}'_{sd} \right] + \xi_{sd} + \varepsilon_{sd} \tag{6}$$

To advance a model described by the additional cost. Equation 6 can be measured using maximum simulated probability techniques.

4. RESULTS AND DISCUSSION

Initially, weights were given to every variable. For variables with more than two values, such as product origin and organic, the variances among the higher and lower quantities were measured as their values (Normann, Röding, & Wendin, 2019). For the binary variables, such as traceability and quality certification, the coefficients are precisely measured as their weights. Thus, the percentage of the coefficient of every feature to the valued amount of these variances across features is measured as the estimate of every attribute's relative significance, which results in the following estimates of relative significance: quality certification (31.57%), organic products (23.69%), traceability (18.51%), product origin (15.24%). Additionally, consumers' consciousness of price is significantly influenced by their confidence level. Most notably, price is perceived as an indication of quality, having a positive impact on meat and DIF product selection among consumers who have low confidence in DIF product safety. Baba, Kallas, Costa-Font, Gil, and Realini (2016) described how when the quality of a product is undetermined in the consumer's perception, the price of that product has a positive influence on their perception of product quality.

Table 1. Sample characteristics.

Variable	Description	Number of observations	Percent %
Gender	Male	221	31.39
	Female	483	68.61
Age	18-25	621	88.21
	26-35	66	9.38
	36-45	10	1.42
	46-55	5	0.71
	56 and over	2	0.28
Education	Less than junior high school	1	0.14
	Junior high school	2	0.28
	Senior high school	14	1.99
	College/University	554	78.69
	Graduate School	133	18.89
Household Income (RMB per month)	Less than or equal to 4000	97	13.78
	4001-8000	186	26.42
	8001-12000	203	28.64
	12001-16000	95	13.49
	16001-20000	57	8.1
	More than 20000	66	9.38
Are you happy to purchase meat and DIF products after Covid-19?	Yes	469	66.62
	No	235	33.38
Have you ever purchased meat or DIF products?	Yes	425	60.36
	No	279	39.63

The socio-demographic characteristics of participants are presented in Table 1. The majority (68.61%) of the participants are female, generally the main caretakers of young children in the house. The vast majority (88.21%) of the participants are young adults, aged between 18 and 25. Most of them are well-educated, over (78.69%) have a college or university degree. Most participants' total household monthly income (59.61%) ranges from 8000 to more than 20000 CNY, which is considerably more than the average per capita national income. Compared to the results of previous surveys (Wang, Wang, & Li, 2020), the percentage of consumers who have never purchased meat or DIF products is high (39.63%), meaning that Chinese consumers continue to have concerns regarding the safety of DIF products.

The complete measurement method is explained in the mathematical model above. To explain the data design of all estimating items, we show the percentage of participants that selected the maximum and minimum for each item. This indicates that consumers are more in agreement with negative views regarding the safety of meat and DIF products (Wunderlich et al., 2018). The average number of consumers that agree with the positive declarations is quite low as compared to the number of consumers that agree with the negative declarations, as shown in Table 2.

Table 2. Descriptive statistics of items measuring consumer confidence (in percentage).

Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Positive statements					
I am confident that meat and DIF are safe	1.56	5.68	54.4	30.26	8.1
Meat and DIF are safe in general	0.85	5.68	44.6	41.62	7.24
I am optimistic about meat and DIF safety	1.28	4.4	36.51	48.01	9.8
I am satisfied with meat and DIF safety	0.85	5.97	38.78	46.59	7.81
I am confident that meat produced domestically is safe after Covid-19	0.71	2.84	35.37	49.43	11.65
I am confident that DIF products produced domestically are safe after Covid-19	0.57	3.55	38.21	49.15	8.52
Negative statements					
I panic as a result of meat and DIF incidents in the past	3.69	25.14	40.06	27.41	3.69
Problems that occur relating to meat and DIF make me angry	3.13	13.49	29.69	39.2	14.49
It scares me that there are problems with managing meat and DIF products	3.69	13.78	41.19	35.09	6.25

The mean scores of consumer confidence for each of the elements are presented in Table 3. The mean scores for positive statements are low compared to those for the negative statements – a validated analysis highlights the significant difference between them ($t = 11.37$, P-value <0.0001), showing that Chinese consumers had a lower level of confidence in the safety of meat and DIF products at the time of the survey in 2021. Moreover, analyzing the mean scores of every item reveals that Chinese consumers with less confidence mostly based their negative views and distress about the safety of meat and DIF products on previous safety events involving DIF products. To evaluate the effects of consumer confidence on consumer preference for meat and DIF products, elements relating to the outcomes of consumer attitudes were analyzed and applied to the descriptive items in the experiments below.

Table 3. Mean scores of dimensions in consumer confidence.

Statement	Mean	Standard deviation
Positive statements		
I am confident that meat and DIF are safe	3.37	0.777
Meat and DIF are safe in general	3.48	0.748
I am optimistic about meat and DIF safety	3.60	0.774
I am satisfied with meat and DIF safety	3.54	0.758
I am confident that meat produced domestically is safe after	3.68	0.740

Statement	Mean	Standard deviation
Covid-19.		
I am confident that DIF products produced domestically are safe after Covid-19	3.61	0.716
Negative statements		
I panic as a result of meat and DIF incidents in the past	3.02	0.906
Problems that occur relating to meat and DIF make me angry	3.48	0.999
It scares me that there are problems with managing meat and DIF products	3.26	0.904

Although the principal component technique was applied to investigate the primary structural construct of the estimating factors, a clarifying process is usually employed to measure item outcomes (Distefano & Mindrila, 2013). The least-squares regression technique was applied in this analysis as a clarifying process to predict element outcomes. The item results on consumer behaviors and attitudes, like the forecast variables, are estimated through regression coefficients, which are acquired through the matrix of item feedings, multiplying the inverse of the perceived variable association. Finally, the calculated element scores of consumer behavior are normalized to show means and standard deviations.

Table 4. Estimation results of the mixed logit model.

Constructs	Model 1							
95% Confidence interval for Exp (B)								
Product attributes								
Items	Coef.	Std. Error	Wald	df	Sig.	Exp(B)	Lower Bound	Upper Bound
Price	–0.233	0.126	3.390	1	0.066	0.792	0.618	1.015
Organic	0.071*	0.120	0.343	1	0.558	1.073	0.848	1.359
Traceability	0.036**	0.125	0.085	1	0.770	1.037	0.812	1.324
Quality	–0.661	0.145	20.743	1	0.000	0.517	0.389	0.686
Observations	704							
Likelihood	273.46							
AIC	283.46							
BIC	306.24							
Constructs	Model 2							
95% Confidence interval for Exp (B)								
Product attributes								
Items	Coef.	Std. Error	Wald	df	Sig.	Exp(B)	Lower Bound	Upper Bound
Price	–0.036	0.123	0.086	1	0.769	0.965	0.758	1.227
Organic	0.016**	0.116	0.018	1	0.893	1.016	0.809	1.275
Traceability	0.037**	0.122	0.094	1	0.759	1.038	0.818	1.317
Quality	–0.381	0.141	7.305	1	0.007	0.683	0.518	0.900
Interaction with consumer confidence dimensions								
Liking×Price	0.561***	0.073						
Disliking×Price	0.272***	0.037						
Liking×Organic	0.009**	0.068						
Disliking×Organic	0.003**	0.081						
Liking×Traceability	0.021**	0.072						
Disliking×Traceability	0.008**	0.084						
Liking×Quality	0.253***	0.089						
Disliking×Quality	–0.161	0.030						
Observations	704							
Likelihood	316.53							
AIC	326.53							
BIC	349.32							

Note: AIC, Akaike Information Criterion; BIC, Bayesian Information Criterion. Nanjing was used as the benchmark for origin and consumer confidence in product features. ***, P <0.01; **, P <0.05; *, P <0.1.

The measurement results of the mixed logit model are explained above in Equation 3, under the mathematical model section. Utilizing the standard equation, Model 1 involves one unplanned coefficient of the four product features. Model 2 additionally permits consumers' perceptions to vary across their liking and disliking behaviors. Concerning the capture of possible diversification in consumer selections of meat and DIF products, the coefficients of the product features are considered to maintain a normal distribution in both models. In Model 2, some quality satisfaction evaluations of product features are estimated, considering the absence of diversification created by consumer confidence, as shown in Table 4. Standard deviations of factor distributions that differ notably from zero suggest diversification in the evaluation of the factors compared to their respective means (Hensher, Rose, & Greene, 2005; Leifman, 2003; Umeair, Luo, Liu, Faisal, & Ullah, 2020).

In comparison with the combined product characteristics, the coefficients of the association phrases are perceived to be nonrandom; therefore, only their means compared with their standard deviations are presented. Examining each model using the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC), the fit of Model 2 is revealed to be better than that of Model 1, highlighting that the formation of relationship expressions is useful to increase the fit of the model. Comparing Models 1 and 2 yields some significant findings. First, in each model, the evaluated combinations of complete product features, apart from price, are extremely significant, approaching the 1% level, and indicate that the presence of any of these features is considered to increase consumers' confidence in meat and DIF product consumption. Thus, though not significant in Model 1, the price has a measurable negative effect in Model 2, the model with associated relationship terms. As the effect of price is less important than the effects of other features, it is clear that non-price characteristics play a significantly greater role than price in affecting Chinese consumers' meat and DIF product purchasing behavior. In addition, of the four studied features, quality certification has the greatest influence on consumers' selection of meat and DIF products, compared to organic status and traceability. Overbosch and Blanchard (2014) described several attributes that considered different levels and values and measured the correlation between these features by applying the changes among the coefficients of these estimates as the standard of assessment.

4.1. Premium Pay Estimates and Influence of Consumer Confidence Levels

We estimated consumer confidence in the safety of meat and DIF products using a standard based on consumer behavior concerning the features of each product. Our study utilized a preference measurement based on four safety and quality features and examined the impact of consumer confidence on consumers' choices of meat and DIF products. Some previous studies have individually highlighted Chinese consumers' preferences for traceability and organic certification of infant formula (Zhang, Fan, Cao, Chen, and Chen, 2021). We found that among the four features being investigated, quality certification was the most desirable attribute, followed by traceability and organic origin. The results of the mixed logit models indicate that consumers' choice of meat and DIF products changes according to the level of consumer confidence in the safety of meat and DIF products.

The detailed result of consumers' WTP premium prices for quality certification (as estimated using Equation 5) was (285.3 CNY), followed by meat and DIF products produced in Jiangsu (191.6 CNY), organic products (189.1 CNY), and traceability (143.7 CNY). As demonstrated by the significance of the deviation factors, there is significant diversification in consumers' WTP premium prices for organic products, traceability, quality certification, and meat and DIF products produced in Jiangsu, as shown in Table 5. The calculated values of the nonrandom relationship intervals highlight the fact that consumers are willing to pay extra for traceability and that organic products greatly affect their confidence levels. In line with the above analysis, consumers with a liking or positive approach are ready to pay more for quality certification and traceability. In contrast, consumers with a disliking or negative approach are willing to pay extra for organic products, which these consumers regard as an indication of safer and healthier meat and DIF products.

148

Table 5. Estimates of WTP premium prices for product features (CNY 1200 g^{-1}).

Liking approach	Sum of squares	df	Mean Square	F	Sig
Price	20.423	4	5.106	10.510	0.000***
Organic	18.864	4	4.716	7.999	0.000***
Traceability	24.329	4	6.082	10.320	0.000***
Quality	55.273	4	13.818	33.497	0.000***
Disliking approach	Sum of squares	df	Mean Square	F	Sig.
Price	4.791	4	1.198	2.357	0.000***
Organic	4.217	4	1.054	1.727	0.000***
Traceability	1.740	4	0.435	0.700	0.000***
Quality	4.228	4	1.057	2.177	0.000***
Variable	Mean effect		Std. Deviation effect	
	Coef.	SE	Coef.	SE
Price	−0.0054	0.0269	−0.0045	1.868
Liking×price	0.0854**	0.0081	0.0706**	0.564
Disliking×price	0.0414***	0.0062	0.0342	0.433
Organic	0.0024***	0.0295	0.0020***	2.048
Liking×organic	0.0013***	0.0089	0.0011	0.618
Disliking×organic	0.0004***	0.0068	0.0003	0.475
Traceability	0.0056***	0.0296	0.0046***	2.055
Liking×traceability	0.0031***	0.0089	0.0026	0.620
Disliking×traceability	0.0012***	0.0068	0.0010	0.476
Quality	−0.0580	0.0263	−0.0480	1.826
Liking×quality	0.0385***	0.0079	0.0318	0.551
Disliking×quality	−0.0245	0.0061	−0.0202	0.423

Note: Estimates of WTP premium prices for each product feature. Nanjing was used as the benchmark for origin and consumer confidence in product features. ***, P <0.01; **, P <0.05.

Table 6. Fornell-Larcker criterion value.

Variables	1	2	3
Food purchase confidence	0.542*** (0.0385)		
Product purchase confidence lowering reasons		0.183*** (0.0352)	
Consumer market environment experience			0.720*** (0.0409)
Constant	1.656*** (0.111)	2.334*** (0.133)	0.507*** (0.147)
Observations	440	440	440
R-squared	0.338	0.082	0.473

Note: Robust standard errors in parentheses.
*** P <0.01.

The circumstances of urban China additionally support the positive effect of price on consumers with a disliking or negative perception. Due to their wealth and the effect of the previous "one-child policy," Chinese parents have always made huge efforts to provide a healthy diet to their only child – although the recent "three-child policy" may lead to different results in the future. Therefore, parents with less confidence in the safety of meat and DIF products are ready to pay a higher price to assure that the meat and DIF products consumed by their children are of the best quality. Currently, despite the increase in prices in recent years, imported formulas are very popular among Chinese consumers, who perceive the high prices to be an indication of superior quality; the Fornell-Larcker criterion values of the association between products and consumer confidence are presented in Table 6. Moreover, there is significant heterogeneity in consumers' choices for the organic and traceability features of meat and DIF products.

Figure 2 shows how the effects of production-to-consumption traceability and the origin of raw milk significantly change consumer confidence levels. As in the disliking approach, consumers mostly select products with accessible traceability networks. In addition, liking approach consumers are swayed by the origin of products (Hafeez Ullah, Wang, Mohsin, Jiang, & Abbas, 2022).
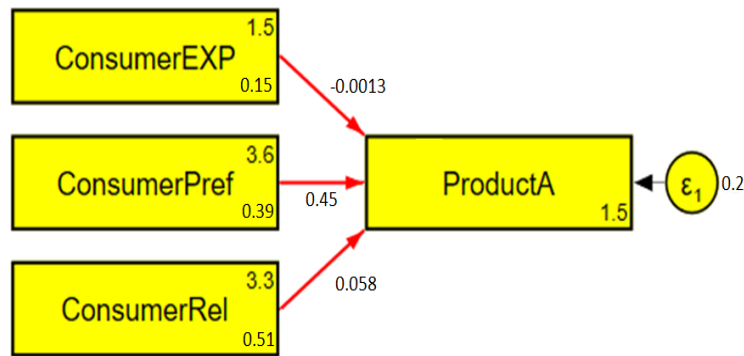
Figure 2. Measurement model.

Table 7. Robust analysis.

Consumer purchase confidence criteria	Model 1
Consumer market environment experience	0.535***
	(0.0452)
Food purchase confidence	0.251***
	(0.0359)
Product purchase confidence lowering reasons	0.0656***
	(0.0229)
Constant	0.319**
	(0.138)
Observations	440
R-squared	0.538

Note: Robust standard errors in parentheses.
*** $P < 0.01$, ** $P < 0.05$.

Above, we noted that price has a positive effect on preferences for DIF products for consumers with disliking or negative attitudes towards the safety of meat and DIF products. After that, consumers' confidence levels are significantly influenced by their preferences, and they are willing to pay extra for traceability. Production-to-consumption traceability is an important factor for consumers with a negative approach to the safety of meat and DIF products, although consumers with positive attitudes are less likely to pay extra for traceability. The results suggest the importance of including consumer confidence as a necessary psychological factor in efforts to understand how consumers make purchase decisions regarding meat and DIF products, as presented in Table 7; it may also be useful to improve food safety policies and supply-chain management strategies (Iakovou, Bochtis, Vlachos, & Aidonis, 2015).

Table 8. Full collinearity estimates.

Full collinearity estimates	Consumer market environment experience	Food purchase confidence	Product purchase confidence lowering reasons
VIF	1.497	1.489	1.076
Score	0.668	0.672	0.93

Table 8 shows the full collinearity estimates for all the latent variables. A VIF equal to or greater than 10 suggests collinearity.

5. CONCLUSION

This study explains the behavior of Chinese consumers living in downtown Nanjing, a city in Eastern China, whose confidence in the safety of meat and DIF products has decreased recently due to the COVID-19 pandemic, which occurred as the result of a food safety incident in late December 2019. The study outcomes reveal that quality certification, which is perceived as the most desirable product characteristic by consumers, should be considered an essential feature of meat and DIF products. Therefore, encouraging the development of an efficient production-to-

consumption traceability network would be useful to develop a sustainable market environment and increase Chinese consumer confidence in meat and DIF products. Strategy implementations on increasing consumers' perceptions of the safety of meat and DIF products might be required to enhance the current system and facilitate advanced guidance on the manufacturing process of meat and dairy products, quality assessment, and techniques applied to increase the safety of meat and DIF products – specifically, knowledge about the traceability network, organic routines, and safety procedures (Pullman & Wu, 2021). From a supply-chain management point of view, improving traceability networks can benefit local dairy firms and markets by increasing the premiums they can charge consumers, particularly given Chinese consumers' loss of confidence after Covid-19. Chinese dairy producers should also improve organic feedings and increase their use of local raw milk, which is shown to be appealing to Chinese consumers. Moreover, providing organic feed to the animals may also support dairy firms in attracting consumers who demand high-quality meat and DIF products. This study does, however, have certain limitations. First, the assessments of consumer confidence and purchase behavior in this study might be internal. In particular, consumers who had acquired inferior quality meat and DIF products before this survey might have a negative attitude regarding meat and DIF products; and it is their negative purchase intentions, rather than their negative approach, that has lessened their preference for consuming meat and DIF products. Thus, comparing the theoretical guidance on bias with the findings of this study highlights that diversification might not be an important concern in the present condition. Importantly, the more likely scenario is that our consumer confidence estimates have increased the influence of a few excluded elements, such as negative purchase intentions, as stated; these excluded elements are possibly positively associated with consumers with a disliking or negative approach and affect already satisfied consumers and their purchase behavior and intentions in the opposite way. A negative attitude has a negative impact on consumer willingness to purchase a product and a positive attitude has a comparatively favorable impact (Friedrich, 2022). Hence, if some factors have been neglected, the perceived effect of the negative attitude curve will be "more downward" and the perceived effect of the positive attitude curve will be biased "more upward." In addition, in this study, while all product features were kept parallel to each other using the measurement method, the relationships among them might also impact consumer confidence. Accordingly, future studies might require parallel mediations to gain more knowledge on consumer confidence. Additionally, to keep the number of features manageable and measurable, this study used four product features in the model to assess the market sustainability environment and the perceived value based on consumer confidence. Other possible key elements, such as knowledge about nutrition, were not included in the model. For future studies, it might be beneficial to take such elements into account.

REFERENCES

Abbas, H., Zhao, L., Faiz, N., Ullah, H., Gong, J., & Jiang, W. (2021). One belt one road influence on perishable food supply chain robustness. *Environment, Development and Sustainability, 24*(7), 9447-9463.

Abbas, H., Zhao, L., Gong, X., Jiang, M., & Faiz, N. (2022). Environmental effects on perishable product quality and trading under OBOR supply chain different route scenarios. *Environmental Science and Pollution Research*, 1-19.

Abbas, M. G., Wang, Z., Bashir, S., Iqbal, W., & Ullah, H. (2021). Nexus between energy policy and environmental performance in China: The moderating role of green finance adopted firms. *Environmental Science and Pollution Research, 28*(44), 63263-63277.

Abbas, M. G., Wang, Z., Ullah, H., Mohsin, M., Abbas, H., & Mahmood, M. R. (2022). Do entrepreneurial orientation and intellectual capital influence SMEs' growth? Evidence from Pakistan. *Environmental Science and Pollution Research, 29*(17), 25774–25789.

Accorsi, R., Ferrari, E., Gamberi, M., Manzini, R., & Regattieri, A. (2016). A closed-loop traceability system to improve logistics decisions in food supply chains: A case study on dairy products. In Advances in Food Traceability Techniques and Technologies (pp. 337-351): Woodhead Publishing.

Aldakhil, A. M., Nassani, A. A., Abro, M. M. Q., & Zaman, K. (2018). Food-beverage-tobacco consumption, smoking prevalence, and high-technology exports influenced healthcare sustainability agenda across the globe. *Environmental Science and Pollution Research, 25*(33), 33249-33263.Available at: https://doi.org/10.1007/s11356-018-3277-3.

Arce Salazar, H., & Oerlemans, L. (2016). Do we follow the leader or the masses? Antecedents of the willingness to pay extra for eco-products. *Journal of Consumer Affairs, 50*(2), 286-314.Available at: https://doi.org/10.1111/joca.12074.

Baba, Y., Kallas, Z., Costa-Font, M., Gil, J. M., & Realini, C. E. (2016). Impact of hedonic evaluation on consumers' preferences for beef attributes including its enrichment with n-3 and CLA fatty acids. *Meat Science, 111*, 9-17.Available at: https://doi.org/10.1016/j.meatsci.2015.08.005.

Bindu, J., Ravishankar, C., & Gopal, T. K. S. (2012). Packaging of retort-processed seafood, meat and poultry. In Advances in Meat, Poultry and Seafood Packaging (pp. 333-362). Woodhead Publishing.

Byrd, E. S., Widmar, N. J. O., & Gramig, B. M. (2018). Presentation matters: Number of attributes presented impacts estimated preferences. *Agribusiness, 34*(2), 377-389.Available at: https://doi.org/10.1002/agr.21527.

Costanigro, M., Deselnicu, O., & Kroll, S. (2015). Food beliefs: Elicitation, estimation and implications for labeling policy. *Journal of Agricultural Economics, 66*(1), 108-128.Available at: https://doi.org/10.1111/1477-9552.12085.

Danthurebandara, V. M., Yu, J., & Vandebroek, M. (2011). Sequential choice designs to estimate the heterogeneity distribution of willingness-to-pay. *Quantitative Marketing and Economics, 9*(4), 429-448.Available at: https://doi.org/10.1007/s11129-011-9106-3.

De Jonge, J., Van Trijp, H., Goddard, E., & Frewer, L. (2008). Consumer confidence in the safety of food in Canada and The Netherlands: The validation of a generic framework. *Food Quality and Preference, 19*(5), 439-451.

Distefano, C., & Mindrila, D. (2013). *Cluster analysis. In: Teo, T. (eds) Handbook of Quantitative Methods for Educational Research.* Rotterdam: SensePublishers.

Djokoto, J. G., & Gidiglo, K. F. (2016). Technical efficiency in agribusiness: A meta-analysis on Ghana. *Agribusiness, 32*(3), 397-415.Available at: https://doi.org/10.1002/agr.21457.

Dzwolak, W. (2016). Practical aspects of traceability in small food businesses with implemented food safety management systems. *Journal of Food Safety, 36*(2), 203-213.Available at: https://doi.org/10.1111/jfs.12232.

Ezeudu, O. B., Agunwamba, J. C., Ezeudu, T. S., Ugochukwu, U. C., & Ezeasor, I. C. (2021). Natural leaf-type as food packaging material for traditional food in Nigeria: Sustainability aspects and theoretical circular economy solutions. *Environmental Science and Pollution Research, 28*(7), 8833-8843.Available at: https://doi.org/10.1007/s11356-020-11268-z.

Frewer, L., Van Dijk, H., & Fischer, A. (2010). Consumer perceptions of the risks and benefits associated with food hazards. *Risk Communication and Public Health*, 39-52.Available at: 10.1093/acprof:oso/9780199562848.003.03.

Friedrich, D. (2022). How environmental goals influence consumer willingness-to-pay for a plastic tax: A discrete-choice analytical study. *Environment, Development and Sustainability, 24*(6), 8218-8245.Available at: https://doi.org/10.1007/s10668-021-01781-7.

Galliano, D., & Orozco, L. (2011). The determinants of electronic traceability adoption: A firm-level analysis of French agribusiness. *Agribusiness, 27*(3), 379-397.Available at: https://doi.org/10.1002/agr.20272.

García-Íñiguez de Ciriano, M., Larequi, E., Rehecho, S., Calvo, M. I., Cavero, R. Y., Navarro-Blasco, Í., & Ansorena, D. (2010). Selenium, iodine, ω-3 PUFA and natural antioxidant from Melissa officinalis L.: A combination of components from healthier dry fermented sausages formulation. *Meat Science, 85*(2), 274-279.

Grubor, A., Milicevic, N., & Djokic, N. (2018). Serbian organic food consumer research and bioeconomy development. *Sustainability, 10*(12), 1-12.Available at: https://doi.org/10.3390/su10124820.

Güney, O. I., & Giraldo, L. (2019). Consumers' attitudes and willingness to pay for organic eggs: A discrete choice experiment study in Turkey. *British Food Journal, 122*(2), 678-692.Available at: https://doi.org/10.1108/bfj-04-2019-0297.

Hamann, R. (2016). Our food, our future. *Environment: Science and Policy for Sustainable Development, 58*(4), 2-3.

Hamzaoui Essoussi, L., & Linton, J. D. (2010). New or recycled products: How much are consumers willing to pay? *Journal of Consumer Marketing, 27*(5), 458-468.

Hensher, D. A., Rose, J. M., & Greene, W. H. (2005). *Applied choice analysis: A primer*: Cambridge University Press.

Hole, A. R., & Kolstad, J. R. (2011). Mixed logit estimation of willingness to pay distributions: A comparison of models in preference and WTP space using data from a health-related choice experiment. *Empirical Economics, 42*(2), 445-469.

Hou, B., Wu, L., & Chen, X. (2019). Market simulation of traceable food in China based on conjoint-value analysis: A traceable case of pork. *International Food and Agribusiness Management Review, 23*(1030-2021-198), 735-746.Available at: https://doi.org/10.22434/ifamr2019.0122.

Hussein, M., & Fraser, I. (2018). Hedonic analysis of consumers' valuation of country of origin of meat in the United Kingdom. *Journal of Agricultural Economics, 69*(1), 182-198.Available at: https://doi.org/10.1111/1477-9552.12232.

Iakovou, E., Bochtis, D., Vlachos, D., & Aidonis, D. (2015). Sustainable agrifood supply chain management. *Supply Chain Management for Sustainable Food Networks*, 1-39.Available at: https://doi.org/10.1002/9781118937495.ch1.

Isaak, M., & Lentz, W. (2020). Consumer preferences for sustainability in food and non-food horticulture production. *Sustainability, 12*(17), 1-16.Available at: https://doi.org/10.3390/su12177004.

Janssen, M., & Hamm, U. (2012). Product labelling in the market for organic food: Consumer preferences and willingness-to-pay for different organic certification logos. *Food quality and preference, 25*(1), 9-22.Available at: https://doi.org/10.1016/j.foodqual.2011.12.004.

Jenkins-Smith, H., & Kunreuther, H. (2001). Mitigation and benefits measures as policy tools for siting potentially hazardous facilities: Determinants of effectiveness and appropriateness. *Risk Analysis, 21*(2), 371-382.Available at: https://doi.org/10.1111/0272-4332.212118.

Kertesz, B. (2017). Discrete response models. In The econometrics of multi-dimensional panels (pp. 163-194). Cham: Springer.

Kim, J. (2020). Analysis for growth potential in response to changes in the online food market. *Sustainability, 12*(11), 1-20.Available at: https://doi.org/10.3390/su12114386.

Kucher, A., Hełdak, M., Kucher, L., & Raszka, B. (2019). Factors forming the consumers' willingness to pay a price premium for ecological goods in Ukraine. *International Journal of Environmental Research and Public Health, 16*(5), 859.

Kuester, I., & Vila, N. (2017). Health/Nutrition food claims and low-fat food purchase: Projected personality influence in young consumers. *Journal of Functional Foods, 38*, 66-76.Available at: https://doi.org/10.1016/j.jff.2017.08.046.

Lakner, Z., Plasek, B., Kasza, G., Kiss, A., Soós, S., & Temesi, Á. (2021). Towards understanding the food consumer behavior–food safety–sustainability triangle: A bibliometric approach. *Sustainability, 13*(21), 1-23.Available at: https://doi.org/10.3390/su132112218.

Lazar, N., & Chithra, K. (2021). Role of culture in sustainable development and sustainable built environment: A review. *Environment, Development and Sustainability, 24*(5), 5991-6031.

Leifman, H. (2003). Who drinks more in Sweden? A study on consumption trends among men and women and in various age groups during 1990–2002. *Nordic Studies on Alcohol and Drugs, 20*(2-3), 159-180.Available at: https://doi.org/10.1177/1455072503020002-316.

Li, J., Chavas, J. P., Etienne, X. L., & Li, C. (2017). Commodity price bubbles and macroeconomics: Evidence from the Chinese agricultural markets. *Agricultural Economics, 48*(6), 755-768.Available at: https://doi.org/10.1111/agec.12372.

Loureiro, M. L., & Umberger, W. J. (2007). A choice experiment model for beef: What US consumer responses tell us about relative preferences for food safety, country-of-origin labeling and traceability. *Food Policy, 32*(4), 496-514.

Luckemeyer, T., Miller, R., Kerth, C., & Adhikari, K. (2016). Beef flavor attributes and consumer perception II. *Meat Science*(112), 114.Available at: https://doi.org/10.1016/j.meatsci.2015.08.035.

Meixner, O., & Katt, F. (2020). Assessing the impact of COVID-19 on consumer food safety perceptions—A choice-based willingness to pay study. *Sustainability, 12*(18), 1-18.Available at: https://doi.org/10.3390/su12187270.

Mohsin, M., Ullah, H., Iqbal, N., Iqbal, W., & Taghizadeh-Hesary, F. (2021). How external debt led to economic growth in South Asia: A policy perspective analysis from quantile regressions. *Economic Analysis and Policy, 72*, 423-437.

Mumtaz, M., Hussain, N., Baqar, Z., Anwar, S., & Bilal, M. (2021). Deciphering the impact of novel coronavirus pandemic on agricultural sustainability, food security, and socio-economic sectors—a review. *Environmental Science and Pollution Research, 28*(36), 49410-49424.Available at: https://doi.org/10.1007/s11356-021-15728-y.

Nelson, P. (1974). Advertising as information. *Journal of Political Economy, 82*(4), 729-754.

Nilsson, T., Foster, K., & Lusk, J. L. (2006). Marketing opportunities for certified pork chops. *Canadian Journal of Agricultural Economics, 54*(4), 567-583.Available at: https://doi.org/10.1111/j.1744-7976.2006.00067.x.

Normann, A., Röding, M., & Wendin, K. (2019). Sustainable fruit consumption: The influence of color, shape and damage on consumer sensory perception and liking of different apples. *Sustainability, 11*(17), 1-9.Available at: https://doi.org/10.3390/su11174626.

Overbosch, P., & Blanchard, S. (2014). Principles and systems for quality and food safety management. In Food Safety Management (pp. 537-558): Academic Press.

Parry, M. E., & Kawakami, T. (2015). Virtual word of mouth and willingness to pay for consumer electronic innovations. *Journal of Product Innovation Management, 32*(2), 192-200.Available at: https://doi.org/10.1111/jpim.12178.

Pizzuti, T., & Mirabelli, G. (2015). The Global Track&Trace System for food: General framework and functioning principles. *Journal of Food Engineering, 159*, 16-35.Available at: https://doi.org/10.1016/j.jfoodeng.2015.03.001.

Pullman, M., & Wu, Z. (2021). Sustainable food supply chains & certifications. *Food Supply Chain Management*, 267-282.Available at: 10.4324/9780429329883-12.

Sadiq, M., Hsu, C., Zhang, Y., & Chien, F. (2021). COVID-19 fear and volatility index movements: Empirical insights from ASEAN stock markets. *Environmental Science and Pollution Research, 28*(47), 67167-67184.

Schnettler, B., Ares, G., Sepúlveda, N., Bravo, S., Villalobos, B., Hueche, C., & Lobos, G. (2019). Are consumers willing to pay more for reformulated processed meat products in the context of the implementation of nutritional warnings? Case study with frankfurters in Chile. *Meat Science, 152*, 104-108.Available at: https://doi.org/10.1016/j.meatsci.2019.02.007.

Shukla, N., & Iyengar, S. (2014). Economic sustainability in light of consumer behaviour: Gandhian perspectives. In Environment and Sustainable Development (pp. 159-171). New Delhi: Springer.

Siegrist, M., & Hartmann, C. (2020). Consumer acceptance of novel food technologies. *Nature Food, 1*(6), 343-350.Available at: https://doi.org/10.1038/s43016-020-0094-x.

Tao, Q., Iftekhar, A., Cai, Z., & Cui, X. (2021). Blockchain-based rice supply chain traceability to ensure rice quality and food safety.

Tauxe, R. (2019). Outbreak: Foodborne illness and the struggle for food safety. *Emerging Infectious Diseases, 25*(12), 2342.Available at: https://doi.org/10.3201/eid2512.191192.

Tobin, B. D., O'Sullivan, M. G., Hamill, R., & Kerry, J. P. (2014). European consumer attitudes on the associated health benefits of neutraceutical-containing processed meats using Co-enzyme Q10 as a sample functional ingredient. *Meat science, 97*(2), 207-213.Available at: https://doi.org/10.1016/j.meatsci.2014.01.010.

Todd, E. C. (2017). Foodborne disease and food control in the Gulf States. *Food Control, 73*, 341-366.Available at: https://doi.org/10.1016/j.foodcont.2016.08.024.

Torres, A. P., & Marshall, M. I. (2018). Identifying drivers of organic decertification: An analysis of fruit and vegetable farmers. *HortScience, 53*(4), 504-510.

Touri, M. (2020). Producer-consumer communication through digital media: Empowering the consumer. Sustainable Development and Communication in Global Food Networks (pp. 179-215). Cham: Palgrave Macmillan.

Ullah, H., Wang, Z., Abbas, M. G., Zhang, F., & Shahzad, U. (2021). Association of financial distress and predicted bankruptcy: The case of Pakistani banking sector. *The Journal of Asian Finance, Economics and Business, 8*(1), 573–585.Available at: https://doi.org/10.13106/jafeb.2021.vol8.no1.573

Ullah, H., Wang, Z., Mohsin, M., Jiang, W., & Abbas, H. (2022). Multidimensional perspective of green financial innovation between green intellectual capital on sustainable business: The case of Pakistan. *Environmental Science and Pollution Research, 29*(4), 5552-5568.

Umeair, S., Luo, F., Liu, J., Faisal, M., & Ullah, H. (2020). The most consistent and reliable predictors of corporate financial choices in Pakistan: New evidence using BIC estimation. *International Journal of Finance and Economics, 27*(1), 237-257.Available at: https://doi.org/10.1002/ijfe.2149.

Usmani, M. S., Wang, J., Ahmad, N., Ullah, Z., Iqbal, M., & Ismail, M. (2022). Establishing a corporate social responsibility implementation model for promoting sustainability in the food sector: A hybrid approach of expert mining and ISM–MICMAC. *Environmental Science and Pollution Research, 29*(6), 8851-8872.Available at: https://doi.org/10.1007/s11356-021-16111-7.

Vecchio, R., & Annunziata, A. (2015). Willingness-to-pay for sustainability-labelled chocolate: An experimental auction approach. *Journal of Cleaner Production, 86*, 335-342.

Wang, H. H., Zhang, X., Ortega, D. L., & Olynk Widmar, N. J. (2013). Information on food safety, consumer preference and behavior: The case of seafood in the US. *Food Control, 33*(1), 293-300.

Wang, X., & Liu, L. (2013). Optimal reliability, warranty length, price and service quality for repeat purchase products. In The 19th International Conference on Industrial Engineering and Engineering Management (pp. 917-927). Berlin, Heidelberg: Springer.

Wang, Z., Mao, Y., & Gale, F. (2008). Chinese consumer demand for food safety attributes in milk products. *Food Policy, 33*(1), 27-36.

Wang, Z., Rafait Mahmood, M., Ullah, H., Hanif, I., Abbas, Q., & Mohsin, M. (2020). Multidimensional perspective of firms' IT capability between digital business strategy and firms' efficiency: A case of Chinese SMEs. *SAGE Open, 10*(4), 2158244020970564.

Wang, Y., Wang, L., & Li, Z. (2020). Dynamic analysis of China's imported raw milk powder consumption. *Sustainability, 12*(4), 1-15.Available at: https://doi.org/10.3390/su12041542.

Wann, J.-W., Yang, Y.-C., & Huang, W.-S. (2016). An empirical analysis of consumer willingness to pay for domestically grown product attributes: The case of Taiwan. *China Agricultural Economic Review, 8*(2), 215-229.Available at: https://doi.org/10.1108/caer-05-2015-0051.

Wentholt, M., Rowe, G., König, A., Marvin, H., & Frewer, L. (2009). The views of key stakeholders on an evolving food risk governance framework: Results from a Delphi study. *Food Policy, 34*(6), 539-548.Available at: https://doi.org/10.1016/j.foodpol.2009.06.002.

Whitehead, J. C., Weddell, M. S., & Groothuis, P. A. (2016). Mitigating hypothetical bias in stated preference data: Evidence from sports tourism. *Economic Inquiry, 54*(1), 605-611.Available at: https://doi.org/10.1111/ecin.12253.

Williamson, D. (2018). Food, feed and sustainable diets. *Farming, Food and Nature*, 232-235.

Wilson, L., & Lusk, J. L. (2020). Consumer willingness to pay for redundant food labels. *Food Policy, 97*, 101938.Available at: https://doi.org/10.1016/j.foodpol.2020.101938.

Wu., Y., & Wang, S. (2021). Sustainable market entry strategy under a supply chain environment. *Sustainability, 13*(6), 1-15.Available at: https://doi.org/10.3390/su13063046.

Wunderlich, S., Gatto, K., & Smoller, M. (2018). Consumer knowledge about food production systems and their purchasing behavior. *Environment, Development and Sustainability, 20*(6), 2871-2881.Available at: https://doi.org/10.1007/s10668-017-0021-y.

Yadav, S., Luthra, S., & Garg, D. (2021). Modelling Internet of things (IoT)-driven global sustainability in multi-tier agri-food supply chain under natural epidemic outbreaks. *Environmental Science and Pollution Research, 28*(13), 16633-16654.Available at: https://doi.org/10.1007/s11356-020-11676-1.

Yontar, E., & Ersöz, S. (2021). Sustainability assessment with structural equation modeling in fresh food supply chain management. *Environmental Science and Pollution Research, 28*(29), 39558-39575.Available at: https://doi.org/10.1007/s11356-021-13478-5.

Yu, X. (2010). Book review: Train, Kenneth. 2003. Discrete choice methods with simulation (pp. 334). Cambridge, UK: Cambridge University Press.

Zhang, M., Fan, Y., Cao, J., Chen, L., & Chen, C. (2021). Willingness to pay for enhanced mandatory labelling of genetically modified soybean oil: Evidence from a choice experiment in China. *Foods, 10*(4), 1-13.Available at: https://doi.org/10.3390/foods10040736.