Imported food consumption intention shifting during COVID-19: Turning a problem into an opportunity?

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ABSTRACT

With the increasing value of import food, the extra greenhouse gas (GHG) emission generated at food's logistic phase can't be ignored in China. While changing food consumers' preference of import food over domestic food products has been difficult, the current COVID-19 pandemic may provide a bright side for shifting consumers' intention. This paper first proposes that food safety, which used to be a highly anticipated attribute of import food, has lost its superiority due to possible contamination of the virus. Then the antecendent of such intention change has been analyzed. The preference changes for Chinese food consumers can then be guided for supply-side structural change to save energy. Further policy and managerial recommendations can be given based on the results for energy saving.

Keywords: Import food, energy-saving, consumer intention, food policy, COVID-19

1. INTRODUCTION

International food trade generated greenhouse gas (GHG) emission through extended food transportation distance. Since the term "food miles" was first proposed by SAFE Alliance in the Food Miles Report (1994), the environmental problem caused by food transportation draw attention from environmental and energy studies. Food miles is a simplistic idea which implicit that the larger the total distance food travelled from the field to the consumer's table, the more negative environmental impact it creates (Lang & Heasman, 2004). Based on the concept of food miles, some research had been conducted to assess the extent of such negative impact at both national level and regional level. For example, Kissinger (2012) estimated that about 30% of total food commodities are imported in Canada annually, which resulting in over 61 billion tonnes km food miles; This is equivalent to about 3.3 million metric tonnes of carbon dioxide. Further, Avetisyan et al., (2013) evaluated that the global GHG emission will fall by 2,070 MT carbon dioxide equivalent if EU consumers shift from imported ruminant food consumption to domestic consumption pattern. In China, with the large volume of imported food consumption and increasing food importation on main agricultural and livestock products, the potential benefits of shifting from purchasing imported food to domestic produced food will be huge. Fig.1. shows the volume of total food imported and growing trend of main imported food products value in China (National Bureau of Statistics of China; FAO). Some scholars have criticized the credibility of food miles and consider such evaluation is oversimplified, and whether imported food can reduce carbon dioxide emission should take domestic food production carbon intensity into consideration (Van



Fig 1 Total value and main import food value in China

Passel, 2010; Avetisyan et al., 2013). Nevertheless, the potential benefits of reducing carbon footprints of food

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from solely the international logistic phase is huge. Despite the debate over the food importation from energy perspective, the decisive factors for food imports are ensuring national food security and domestic consumer demand.

Food imports depend on the needs of the country and preference of the consumers. For China, food security is an important consideration for food import at national level. For example, as China's domestic soybean production has fallen sharply since 2000 while the demand for soybean grows steadily, imports of genetically modified soybean has become an important channel to ensure food security in China (Hairong et al., 2017). Further, the more fundamental reason for food imports is the consumer preference over foreign food products. Curtis et al., (2007) found out that the taste preference over western foods has attracted young Chinese consumers in buying the import food. In addition, Chinese food consumers consider food originates from overseas to have higher quality due to country-of-origin effect, which means that consumers generalize the positive impression of a country's image to the favorable perception of the country's products (Walley et al., 2014).

Moreover, food safety problems in China have been a dominant factor for Chinese consumers to turn to import food. Historically, China has frequent food fraud incidents since 2000. Lam et al., (2013) reviews several incidents that lower the social trust of Chinese food consumers for domestic food products. For example, food coloring chemical additives Sudan IV was found illegally added in eggs of China's food market and may causes cancers in 2006. In 2008, melamine was discovered in domestic brands of infant formula and milk in China that causes kidney stones in babies. Furthermore, overdoes of ractopamine in pig rearing industry has reportedly to cause food poisoning incidents in 2011. While the main agricultural products consuming in China include dairy products, livestock, and livestock products are considered to threat the daily food safety of Chinese food consumers, the mass media exposure of the food fraud incidents in China have raised the public's attention to food safety issue of domestic food products (Zhang and Xue, 2016). Thereafter, Chinese consumers' distrust in domestic food safety has increased (Ortega et al., 2011). Thus, food safety becomes an important attribute demanded by the Chinese food consumers.

However, the perception of food safety for Chinese food consumers may have new meanings in the era of COVID-19 pandemic. The outbreak of the novel

coronavirus SARS-CoV-2 (COVID-19 pandemic) has soon spread to the world in the early 2020 (Burki, 2020). While the world is still battling with the epidemic, China has managed to keep the COVID-19 under control in a rapid and effective way. Therefore, the focus of the epidemic control shifts from "prevention of spreading virus within the boarder" to "prevention of overseas imported cases" in China. Therefore, any imported cases or potential channel of virus entering China attract a great attention from public (Hou et al., 2021). Since the spread of the virus has been controlled in China, sporadic outbreaks of epidemic reported for unknown sources arouses public concerns. The regional outbreaks are later confirmed to be related with imported cold-chain food. For example, two stevedores have tested positive for SARS-CoV-2 during the loading and unloading works of imported frozen cod at Qingdao port (Ma et al., 2021). Further a cold chain food company in Tianjin has been traced as the source of another COVID-19 breakout; both the food packages of imported pork and a dock worker were tested positive for the virus (Song et al., 2020). Bai et al., (2021) reviews the incidents of COVID-19 related to imports frozen food and food in China and finds out that Beijing, Dalian, Qingdao, and Tianjin city have all confirmed cases of COVID-19 through food-related activities; imported food packages like salmon, cod fillets, frozen beef, frozen chicken wings, and frozen pig elbow have tested positive for the virus. The frequent food safety incidents related to the epidemic has attracted growing concern from the Chinese food consumers. However, the research on the possible consumers' shift attitude from domestic food products to import food is limited.

To better understand the consumer's intentional change toward import food and how it may influence the energy saving, this paper first provides an academic investigation in confirming consumers' intention for consuming imported food. Then the path of the intentional changes of import food are further explored.

2. MATERIAL AND METHODS

2.1 Modelling intention to consume import food with partial least squares structural equation modeling (PLS-SEM)

This study tested the conceptual model through partial least squares structural equation modeling (PLS-SEM). The general equations of the partial least squares structural equation modeling for this study are as follows. X=TA^T+D and Y=UB^T+E.

(Where X = n-by-m matrix of predictors; Y = n-by-p matrix of responses; T = n-by-l matrix that is projections of X (the X factor matrix); U = n-by-l matrix that is projections of X (the Y factor matrix); A = m-by-l orthogonal loading matrix; B = p-by-l orthogonal loading matrix; D and E = disturbances).

One goal of this paper is to explore the psychological antecedents of the intention of consuming import food of Chinese food consumer. The partial least square structural equation model (PLS-SEM) is considered the most suitable model to explain the complex. Aside from demographics variables, behavioral intentions and perceived values are hard to observe directly. Thus, the structural equation model approach is adopted, and each variable proposed in this research is measured with multiple statements (Hair et al., 2014). Modeling food waste within the partial least square structural equation modeling approach with food waste reduction and its antecedent variables is proper for its predictive power. Compared to the traditional covariance-based structural equation modeling that focuses on verifying existing theory, partial least squares structural equation modeling adopts a variance-based technique that is considered more appropriate to test explanatory models (Hair et al., 2014). This paper proposed perceived government control as extended variables that haven't been validated before in the context of food waste, so partial least squares structural equation modeling is adopted in this research.

2.2 Fuzzy sets (fsQCA)

fsQCA approach is adopted here to further analyze how the combination of multiple explanatory variables can together influence the dependent variables (Ragin, 2009).

3. Theoretical framework

3.1 Theoretical framework determining the intention to consume import food under COVID-19

3.1.1 Perceived uncertainty

Though multiple food safety incidents related to import food had been confirmed in China, the official reports by Centers for Disease Control and Prevention (CDC) suggests that "there is still no evidence regarding food or food packaging associate with COVID-19" (CDC, 2020, COVID-19 section). The conflicting information between reported incidents happened in China and the statement of trusted health organization may generate public uncertainty toward the safety of import food. In classical economic theory, uncertainty is important in consumer's decision-making process and information is the key antecedent in determining the extent of uncertainty (Stigler, 1961). Therefore, this paper proposes that:

H1: Perceived uncertainty of the information has a positive effect on the perceived risk of import food carrying COVID-19.

3.1.2 Perceived risk

According to various research on risk perception, perceived risk is a multi-dimensional psychological concept that assesses the extent of severity and possibility of an incident (Dowling, 1986). Intuitively, COVID-19 is an incident that has risk attribute. Individual will judge the risk level of getting the COVID-19 from consuming or purchasing the import food. Several research concerning the consumer's risk perceptions around COVID-19 have been published. For example, Sánchez-Cañizares et al., (2020) has investigated consumers' travelling intention with concerning the risk of COVID-19. Thus, this paper suggests that:

H2: Perceived risk of import food carrying COVID-19 has a negative effect on intention to consume import food.

3.1.3 Social amplification of risk framework

The social amplification of risk conceptual framework proposed by Kasperson et al., (1988) investigated the mechanism of how risk of urgent public health spread out. The results showed that informal social networks and mass media exposure were two key information amplification stations that increase the perceived risk of an incident. Therefore, this paper considers that:

H3: Frequent media exposure of import food may contain COVID-19 has a positive effect on the perceived risk of import food carrying COVID-19.

H4: Frequent interpersonal communication of import food may contain COVID-19 has a positive effect on the perceived risk of import food carrying COVID-19.

3.1.4 Conflicting media exposure

With the nature of contradicting information regarding the safety of import food under COVID-19, this paper tries to investigate how the unique situation impact consumers' intention regarding import food. Previous research has found out that conflicting information has negative impacts on the consumer's

decision-making behavioral intention (Nagler et al., 2018). Therefore, this paper also suggests that:

H5: Conflicting media exposure of import food related to COVID-19 has a positive effect on the perceived risk of import food carrying COVID-19.

3.1.5 Perceived source credibility

Perceived source credibility has been investigated in the domain of political science for years. The extent of trust in the information public has will have influence on the behavioral intention of people. If the consumers have confident in the authenticity of the information they receive, they will be more likely to act according to the information. While COVID-19 is a public health emergency, government officials is leading channel of epidemic information distribution. The official reports from CDC China and China's official media all suggest the negative side of import food that possible food-related COVID-19. Thus, we propose that:

H6: The higher the trust in the source of information, the higher the perceived risk of import food carrying COVID-19.

3.1.6 Affective heuristic

Given the situation that the information related to whether import cold chain food may carry COVID-19 is still under uncertainty. As mentioned above, the incidents of import food-borne infections have been confirmed while the CDC and official health organizations deny the possibility of getting the virus at this moment, the decision making of either purchasing import food or not will mainly depend on the affective heuristic. Affective heuristic is defined as a affective mental shortcut for people to make a decision under complicated situation, especially under uncertainty (Finucane et al., 2000). The affective mental shortcut includes but not limited to fear, surprise, pleasure, etc. The affective in this context will mainly be negative feelings such as fear, anxiety, or panic. Thus, we propose that:

H7: The more negative feelings one has on import food, he higher the perceived risk of import food carrying COVID-19.

4. **RESULTS**

A two-stage approach is suggested by Chin (2010) to interpret the partial least squares structural equation modeling results. First, the measurement model should be assessed by running the recommended PLS algorithm with 300 iterations. Then, the structural model and the significance level of path analysis were estimated by adopting bootstrapping with 5000 subsamples.

4.1 Measurement model

The measurement model evaluation followed the recommendations by (Chin, 2010). Item reliability, internal consistency, convergent validity, and discriminant validity are assessed to reflect overall fit of the measurement model. In total, the model has 32 observed variables (OV) forming 8 latent variables (LV). The specific model path is presented in Fig.2.



Fig.2. Hypothesis model

4.1.1 Internal consistency, convergent validity, and discriminant validity

Internal consistency is indicated by composite reliability (CR) since it provided precise reliability results through weighted items based on the construct's own indicator loadings (Hair et al., 2014). CR values were considered adequate between 0.70 and 0.95. The lowest CR values in this model is 0.751, which satisfied the requirement.

Convergent validity of the measurement model was assessed by the values of indicator loadings and average variance extracted (AVE). According to Hair et al., (2014), indicator loadings should ideally be higher than 0.70, which shows that the construct explains more than 50% of the item's variance. All the indicator loadings in this study presented are higher than 0.70. Most indicator loadings are above 0.7, and only one indicator is 0.531. The indicator loading higher than 0.5 is acceptable for exploratory analysis like in this paper.

Discriminant validity needs to be verified for ensuring that a construct is different from other constructs (Hair et al., 2014). Fornell & Larcker criterion and Heterotrait-Mono-trait Ratio were adopted to determine the discriminant validity. Our measurement model passed the discriminant validity with all the AVE value is higher than 0.715.

4.2 Structural model

4.2.1 Predictive ability

After the measurement model was established and verified, the structural model can then be analyzed. R^2, which represents the extent that variance explained of the endogenous construct by exogenous variables, is selected as an important indicator in model predictive accuracy. It is recommended that 0.02, 0.13, 0.26 can be considered small, medium, and large regarding to R^2, values. The R^2 of the model in this paper is 0.339, which can be considered to have strong explanatory power.

4.2.2 Hypothesis testing

The path coefficient significance level and magnitude were then assessed through the bootstrapping approach. The parameters of the path are concordance with our hypothesis. Direct effect of perceived risk of the imported food is positive in the consumer's intention to reduce import food consumption, and the value of the parameter is 0.648. With the value of 0.326, perceived uncertainty of whether import food can contain COVID-19 has positively impact the perceived risk. Further, both interpersonal communication and media exposure of the topic about the possibility of import food containing COVID-19 increase the perceived risk, with the value of 0.083 and 0.161 respectively. With the value of 0.067, the perceived conflicting of information has positive influence on perceived risk. And the perceived source credibility has positive impact on perceived risk with the parameter value to be 0.161.

a) Multi-group analysis

The multi-group analysis is conducted to validate the results we have for the structural model. The data set has been divided into sub-groups for their main media type for receiving information, their vaccination status, and whether they have lived in risky areas. We expect the results of comparisons across the groups to be insignificant to prove the robustness of the results of proposed model. For both media type and vaccination status, we showed that the results from each path in the model is not significant. And for the living experience in the risky areas, we found out all results are insignificant at 1% level.

4.4 fsQCA

First, the necessary conditions are analyzed. The necessary conditions, or in other words, the indispensable factor, for the dependent variable perceived risk are perceived uncertainty and perceived source credibility. The necessary conditions for the intention are perceived risk, perceived source credibility, and perceived uncertainty. Further, the sufficient conditions can reflect how combination of the antecedent variables impact the dependent variables. The sufficient conditions are shown in fig.3.

TRUTH TABLE SOLUTION frequency cutoff: 18 consistency cutoff: 0 944322			
Assumptions:	int		
	raw coverage	unique coverage	e consistency
uncer*risk*credi*~inter	0.58121	0.0336207	0.958218
uncer*risk*media*credi	0.555229	0.0908746	0.972956
~media*credi*~affect*~inter*~conflict	0.407671	0.0198739	0.924742
uncer*risk*credi*affect*~conflict	0.474784	0.012456	0.977799
uncer*risk*~media*affect*~inter*~conflict	0.408257	0.00760722	0.976114
solution coverage:0.739419			
solution consistency: 0.935047			
Fig 3. Sufficien	t conditions fo	or intention	

5. DISCUSSION

The significant results of the path analysis reflect that Chinese food consumers do have changed their views on import food, especially for import cold chain food. The extent of risk consumers perceived turn to strong intention in reducing consumption of import food.

6.CONCLUSION

After confirming that the intention of food consumption has shift from preferring import food to reduce import food consumption, several policy and managerial recommendations can be brought up. First, COVID-19 related information is often released by the government, and the perceived source credibility is crucial independently, so the government should increase the accuracy of information. Ssecond, under the current circumstances, consumers in China have shift food consumption pattern. Thus, foodservice providers and hospitality industry can select alternative food ingredients to further promote business. Third, vaccination status shows no difference in high-risk perception and strong intention in food consumption shifting, thus the government and food industry should prepare for a long-term shift of such change. Fourth, while the uncertainty is the necessary condition for risk perception, and risk perception is the necessary condition for behavioral intention change, thus business industry should acknowledge that the psychological influence will last long whether COVID-19 is over or not. At last, the butterfly has flapped its wings, scholars can refer to these results and propose new way in carbon reduction/energy consumption in food industry.

7. Limitations

Though this paper already proves that the Chinese food consumers have shift their intention in consuming import food due to COVID-19, there are still limitations of this work due to research focus. This study can be further extended from several perspectives. For example, further research can focus on investigating the perceived benefits of domestic food products in China and develop a comprehensive view regarding food preference of Chinese consumers. Moreover, this research aims at exploring the intention of Chinese food consumers in a special era of COVID-19, so scholars should acknowledge the special context of this paper when including the results from this work for further research.

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