

The impact of perceived COVID-19 risks, food waste generation and food purchase control on the food security status during the pandemic.

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Abstract

The outbreak of COVID-19 represents an unprecedented global health scenario closely related to food production and consumption. The transmission of COVID-19 through food and food packaging has been declared as very low by WHO, European Food Safety Authority and the British Food Standards Agency. Therefore, this pandemic radically differs from previous food safety incidents such as bovine spongiform encephalitis, salmonella, or dioxin contamination. However, its consequences for the food sector are related, such as food supply chain shocks and changes in consumer behaviour. One of the reasons behind the shift in consumer behaviour is the 'fear of the unknown' and the amplification of such risks by media coverage. Worldwide media widely reported a rise in demand for food banks and food aid, the disruption of food supply chains, and, with particular importance, the virus outbreaks in food factories, farms, and meat processing plants. We undertook a literature review on perceptions of risk, uncertainty, and safety to understand food purchase and utilisation during the pandemic. Finally, we analysed the impact of factors identified in the literature review, such as consumers' enhanced food safety risk perceptions and distrust towards the stability of the food system as a response to the coronavirus pandemic on food purchase and consumption behaviour and the potential variation in food waste generation.

Keywords COVID-19, risk perception, food security, food waste, structural equation models

JEL code D830; Q180

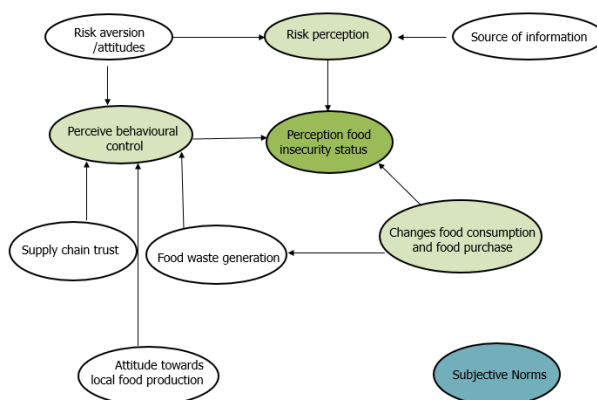
Introduction

Covid 19 represented a radically different scenario from those created by food safety incidents. On the one hand, the transmission of COVID-19 through food and food packaging was declared very low by the WHO, the European Food Safety Authority, and the British Food Standards Agency (EFSA, 2020; Food Standards Agency, 2020; WHO, 2020). On the other hand, it is undeniable that food consumption behaviour has had to change in response to social distancing measures enforced by the government (Laville, 2020) and also due to the disruption of food and non-food supply chains.

Understanding the concept of food scares clarifies the impact of risk perception during Covid 19. Whitworth et al. (2016) studied several food supply chain shocks in Europe, and defined a food scare as “the response to a food incident (real or perceived) that causes a sudden disruption to the food supply chain and to food consumption patterns” (Whitworth et al., 2016, p.133). While food incidents are characterised by threats to food safety or integrity, food scares are characterised by consumer responses and supply chain disruptions. Whereas it is true that most food scares have originated from food safety concerns, Whitworth et al.’s classification importantly include the 2013 horse meat scandal – a moral issue linked to lack of transparency rather than a health issue, and GM technology – towards which consumers are sceptical for reasons that go far beyond health concerns (Costa-Font and Gil, 2009; Whitworth et al., 2016). Although the nature of the COVID-19 pandemic, which is not, per se, related to a food incident, suggests its exclusion from the category of food scares, drawing a parallel between food scares and the COVID-19 pandemic can help to conceptualise the relationship between the latter and the impact of risk and uncertainty on food behaviours.

Several reports from UK-based charities have reported a rise in the levels of household food insecurity around the UK during the pandemic (Pautz and Dempsey, 2022). Based on this evidence, the central focus of our model is the concept of individuals’ perception of food insecurity. Through a literature review, we have defined a conceptual model, see figure 1, that aims at understanding how COVID-19 has altered food-related behaviours and food security perceptions among consumers in Scotland. Particularly, the study examines how the food security perceived status by Scottish consumers has been affected by risk attitudes, risk perception, supply chain trust, and the media, among other elements. In addition, we intended to recognise if food waste behaviours were also impacted and their relation to food insecurity perceptions.

Figure 1. Theoretical Framework of The Study



Source: Own Elaboration.

Literature review

Defined by Olstedal et al. (2004) as “the degree to which mental acknowledgement perceives factors relating to potentially-hazardous activities or technologies determining people’s risk judgements”, risk perception is commonly acknowledged to be influenced by a psychological component (Slovic, 1987; Yeung and Yee, 2005). Consumers can thus perceive risks to be significant even when risks are, de facto, small. Analysing the psychological impacts of past pandemics, Taylor (2019) affirms that psychological factors are especially important in cases of behavioural methods of pandemic management, such as social distancing. Results from studies analysing previous health crises, such as the outbreak of Ebola, the H1N1 swine flu strain, and the SARS (Severe Acute Respiratory Syndrome) coronavirus, indicate that past public health shocks have had pronounced psychological impacts – which tend to be exacerbated by continuous media exposure (Smith, 2006; Garfin, et al., 2020). Results from a study about the risk perception of COVID-19 in Finland indicate that respondents did have emotional responses to risk, and that occurrences such as the lack of food in supermarkets led them to believe that authorities were unable to act (Lohiniva et al., 2020). A study about the risk perception of COVID-19 in Germany found that only 8.3% of the respondents felt safe when they were outside their homes, in places such as supermarkets and shops (Gerhold, 2020). Whilst differences between countries are to be expected, especially insofar as different countries have reported significant differences in COVID-19 deaths, rates of incidence, and management policies, it is reasonable to assume that the general public in the UK would share some of these concerns.

The literature reports that the perception of risks generally impacts individuals’ perception of a behavior or situation. Understanding the uncertainty, and its communication, related to the COVID-19 pandemic is necessary insofar as, in the literature, uncertainty is identified as a factor shaping consumer behaviour in situations of risk (Frewer et al., 2002; Miles and Frewer, 2003). Furthermore, research on past outbreaks of epidemics and pandemics as well as results from a study on Covid 19 indicate that the personal trait ‘intolerance of uncertainty’ can exacerbate emotional and behavioural responses to crises (Taylor, 2019; Mertens et al., 2020). Consumption behaviour – in general as well as in the specific case of food consumption under circumstances of risk and uncertainty – for instance, is determined not only by perceptions of risk, but also by risk attitudes (Wansink, 2004; Alfnes, Rickertsen and Ueland, 2008; Tonsor, Schroeder and Pennings, 2009; Yamoah and Yewson, 2014). Whilst an individual’s risk perception is situation-specific, risk attitudes represent people’s underlying tolerance of risk and represent “a consumer’s general predisposition to risk in a consistent way” (Wansink, 2004, p.119; Tonsor, Schroeder and Pennings, 2009).

Other factors that have been reported to influence the behavioural process regarding food access and consumption are the perception of control and subjective norms. The Theory of Planned Behaviour developed by Ajzen in the 1990s is a well-established and robust theoretical construct used to understand the main factors influencing consumer behaviour. The TPB posits that the performance (or non-performance) of a given behaviour is dictated by a behavioural intention (or lack thereof), which is in turn informed by three essential factors, namely attitude, subjective norm, and perceived behavioural control (Ajzen, 1991).

Several studies have found that traditional and social media play an important role in shaping risk perceptions associated with events such as public health crises (Garfin et al., 2020; Harvey et al., 2001; Lobb et al., 2006; Smith, 2006; Taylor, 2019).

Lobb et al. (2006) found that trust in information provided by the media increased risk perception and thus resulted in a decreased likelihood to purchase chicken products – whilst trust in information provided by public authorities such as the Food Standards Agency moderated the impact of the

hypothetical food scare (Lobb et al., 2006). This serves as further evidence to corroborate the general consensus that risk perception depends not only on trust in the information provided, but also in the source of information (Lobb, 2006).

Trust and attitudes toward the supply chain and stakeholders influence the perception of control of our food purchase and consumption. Another element that has been reported as related to the perception of control is food waste generation. For the purpose of understanding the factors underlying consumer's responses to the coronavirus pandemic with regards to food purchasing behaviour, thus, this study will also assess consumer's underlying attitudes toward risk. It is expected that risk averse consumers will be more likely to have a marked risk perception of COVID-19 and, thus, to engage in more extreme behavioural responses to the coronavirus pandemic with regards to food consumption.

Methods

First, the literature review includes research on past outbreaks of epidemics and pandemics and findings from studies on the new coronavirus indicating that the personal trait 'intolerance of uncertainty' can exacerbate emotional and behavioural responses to crises. A conceptual framework has been developed as a summary of the literature review. Based on this conceptual framework, a survey was designed to model these behaviours using structural equation models (SEM).

Second, we employed SEM to analyse the data and to test the hypotheses developed from the literature review. SEM was chosen as the preferred method for analysis because it allows eliciting responses about concepts, such as attitude, behaviour, and intention, which are multi-dimensional and not directly observable (Westland, 2015). Two-step modelling approach (Anderson and Gerbing, 1988, Jöreskog and Sörbom 1996). First, a confirmatory factor analysis (CFA) relates observed indicators with latent variables as follows:

$$x = \Lambda_x \xi + \delta$$

Where, x is a vector of q observed variables,
 Λ_x is a matrix of $p \times m$ coefficients of the relationship of x on ξ ,
 ξ is a vector of n latent variables,
 δ is a vector of q error terms in x .

Secondly, a Structural Regression model (SEM) is specified using the causal relations among the latent variables as follows:

$$\eta = B\eta + \Gamma\xi + \zeta$$

Where, B is a $m \times m$ matrix giving the coefficients of the endogenous latent variables in the SEM, Γ a $m \times n$ matrix of the exogenous latent variables, ζ is a vector of errors

To perform the analysis, we use the Diagonal Weighted Least-Squares (DWLS) method instead of Maximum likelihood (ML) since the data present a non-normal distribution. To perform the analysis, we use the Diagonal Weighted Least-Squares (DWLS) method instead of Maximum likelihood (ML) since the data present a non-normal distribution.

Data analysis was carried out through R software, mostly using the packages 'lavaan' and 'semTools'.

Data

We collected data using an online survey in 2022. The survey was implemented by a market research company based in the UK. The sample of 502 respondents intends to be representative of the Scottish population in terms of gender, age, education level, and employment status, see Table 1. Each latent construct was measured by a minimum of three and a maximum of five indicators. Forty-five questions were used to create ten constructs or latent variables. All constructs were assessed on a 1-7 Likert scale – respondents were asked to rate their opinions from ‘strongly agree’ to ‘strongly disagree’ and from ‘extremely likely’ to ‘extremely unlikely’. The adoption of 1-7 scales is justified by research showing that the greater the number of scale steps, the less likely respondents are to use the middle scale step – thus expressing their preferences more clearly (Westland, 2015). The order of questions was randomised between respondents.

Table1. Summary of Sample Statistics

Gender	Female	59%
	Male	41%
	Other	0%
Age Group	Younger than 30	21%
	30-39	22%
	40-49	18%
	50-59	18%
	60-69	13%
	70 or older	9%
Education level	Incomplete Secondary Education (Below GC SE / O Level)	2%
	Secondary Education Completed (GCSE / O Level / CSE or equivalent)	15%
	Secondary Education Completed (A Level or equivalent)	19%
	Some Vocational or Technical Qualifications	11%
	University Education Completed (First Degree e.g., BA, BSc)	29%
	Vocational or Technical Qualifications Completed (e.g. HND, NVQ)	13%
	Postgraduate Degree or equivalent	8%
	Doctorate, Post-doctorate or equivalent (Higher Degree)	4%
Employment statu	Employed	61%
	Self-employed	9%
	Retired	11%
	Stay-at-home parent	6%
	Student	7%
	Unemployed	6%
Responsible for grocery	I am fully responsible for the grocery shopping	72%
	I am partially responsible for the grocery shopping	28%

Results

Descriptive statistics

Figure 2 shows that respondents in 2022 were aware of and worried about covid 19. More than 50 percent of respondents considered Covid a serious threat, and around 40 per cent feared the epidemic. By then, a big part of the Scottish population was already immunised. Figure 3 indicated that consumers in Scotland used written or TV news to be informed during the pandemic, whi. At the same time,al media was only considered an influential source of information for around 30 per cent of respondents.

Figure 2. Awareness of Covid 19.

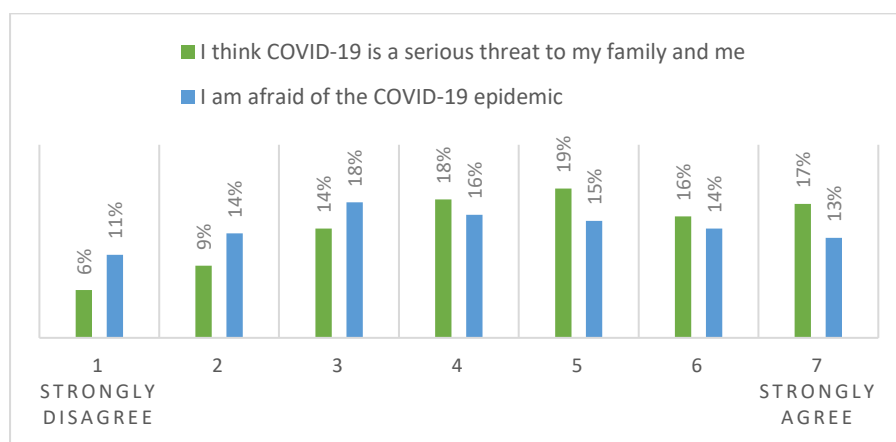
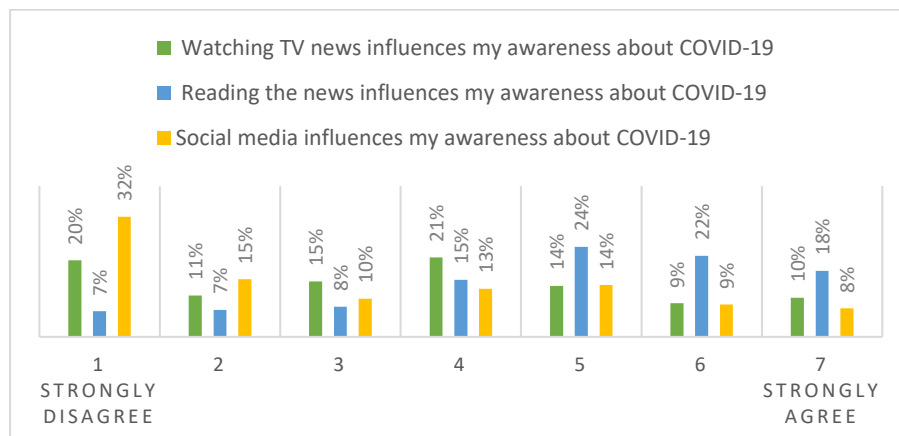


Figure 3. Media influence during Covid 19.



An essential element pointed out during our literature review was the perception of control about the behaviour under uncertainty. For the case of food purchase behaviour, we asked respondents to what extent they felt under control when buying food during the pandemic period. We can observe in Figure 4 that for all questions related to behavioural control, between 50 and 60 per cent of the sample revealed to agree or strongly agree about being in control and being able to choose what they wanted to buy. A further element considered in the survey was the extent Scottish consumers had trust in the food supply chain during the pandemic. Figure 5 shows that between 60 and 70 per cent of

respondents consider that retailers, regulators, and the government were doing a good job keeping the consumer safe. However, when requesting consumers about their food insecurity status, more than 40 per cent of respondents ranked four or more to the question “I was worried at least once that I would run out of food because of a lack of money or other resources” and 33 per cent of respondents ranked four or more to the question “During the COVID-19 pandemic, I had to live (at least once) on a few kinds of food products because of a lack of money or other resources”.

Figure 4. perceived behavioural control.

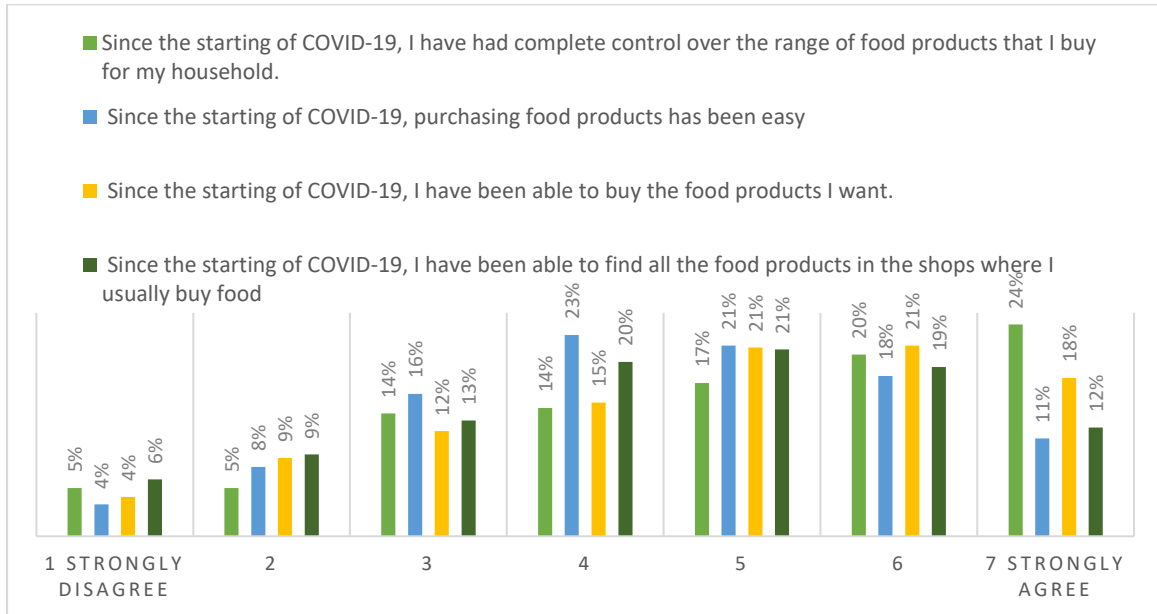
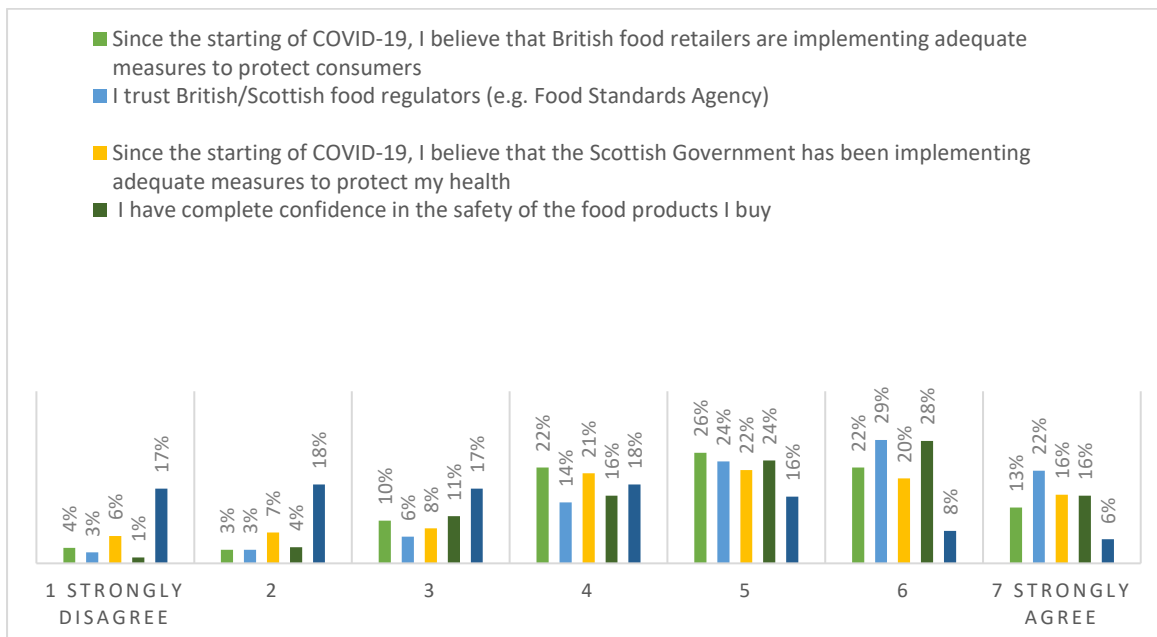


Figure 5. Supply chain trust.



Focusing on how consumer behaviour changed during the pandemic, we asked consumers if they modified their consumption of the products: ready-to-eat foods, frozen foods, snacks, sugary drinks and sweets. As you can see in Figure 6, respondents didn't report a change in food consumption habits for comfort foods, snacks and frozen foods, the ones with more people reporting an increase in consumption. Also, no significant change in food purchase behaviours has been said, just a reduction in shopping trips in the most relevant change, see figure 7. Food waste generation was an additional important element to measure in this research. We wanted to understand if consumers did increase or reduced their waste generation. Figure 8 shows respondents reported not increasing food waste generation during the pandemic.

Figure 6. Change in food consumption habits.

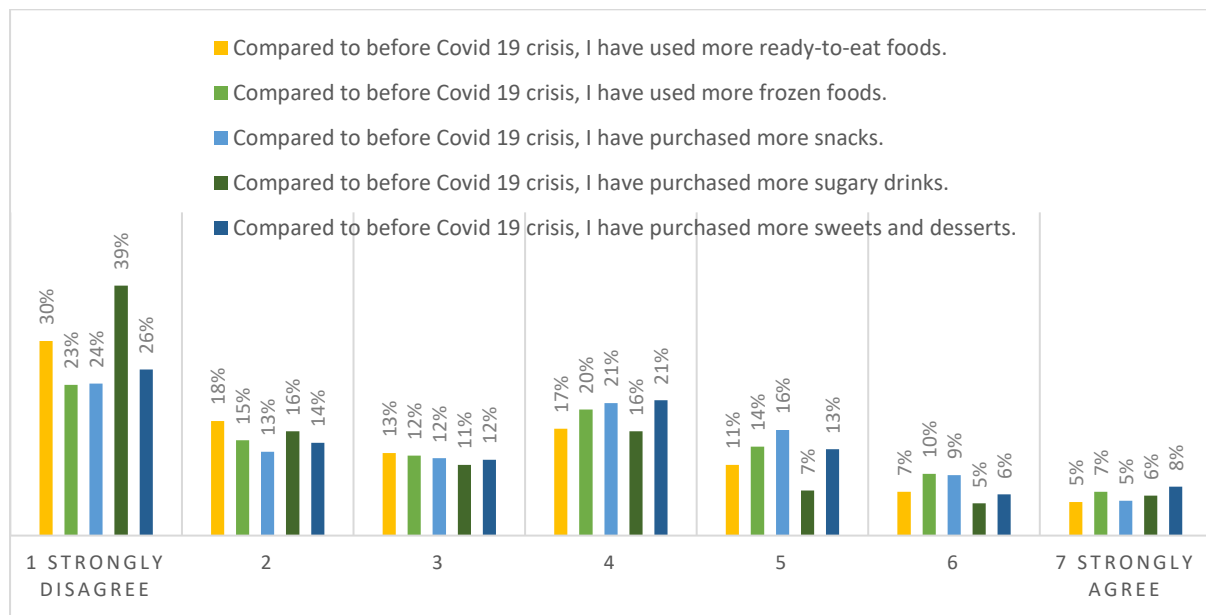
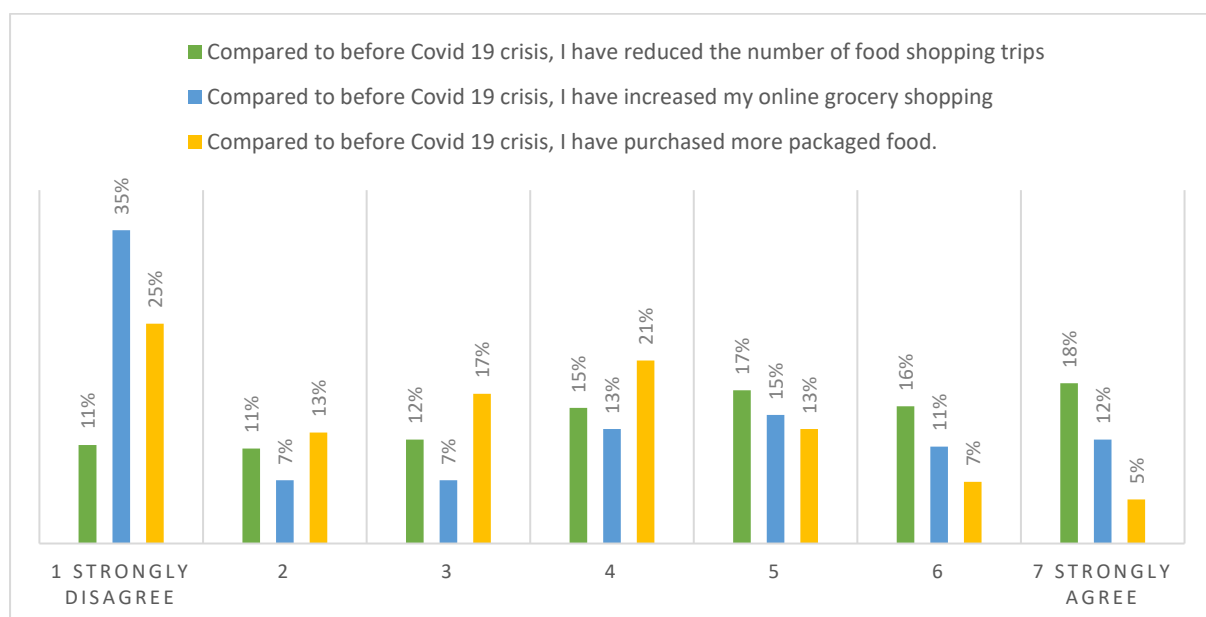


Figure 7. Change in food purchase habits



The last element considered in the survey was the impact of Covid on the rural economy or local food production in Scotland, and respondents revealed to be worried about the effect on the food sector in Scotland, see figure 9.

Figure 8. Change in food waste generation.

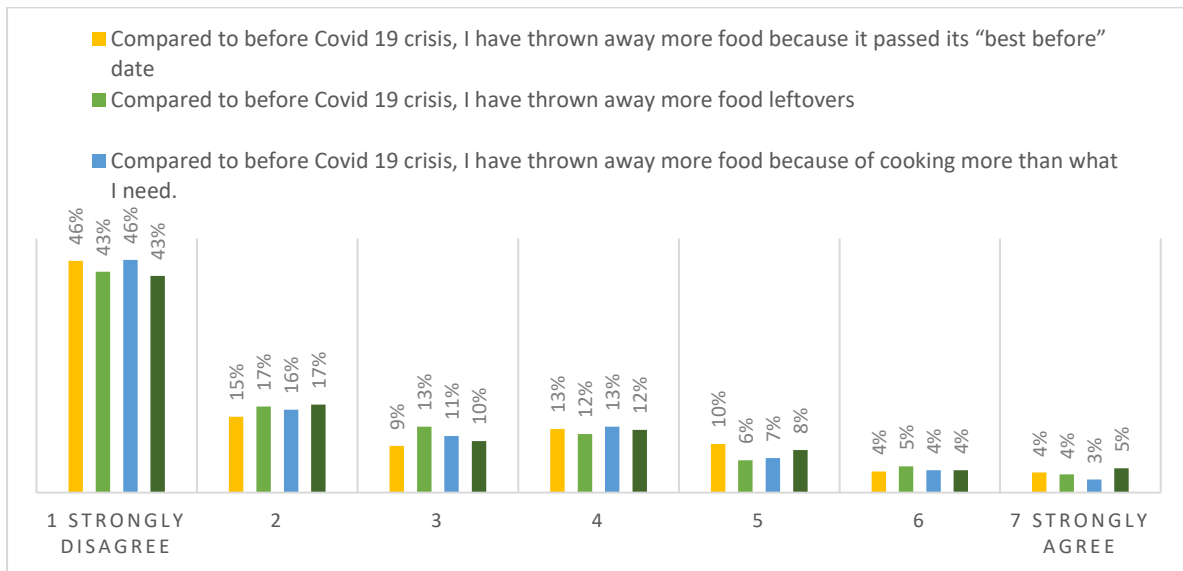
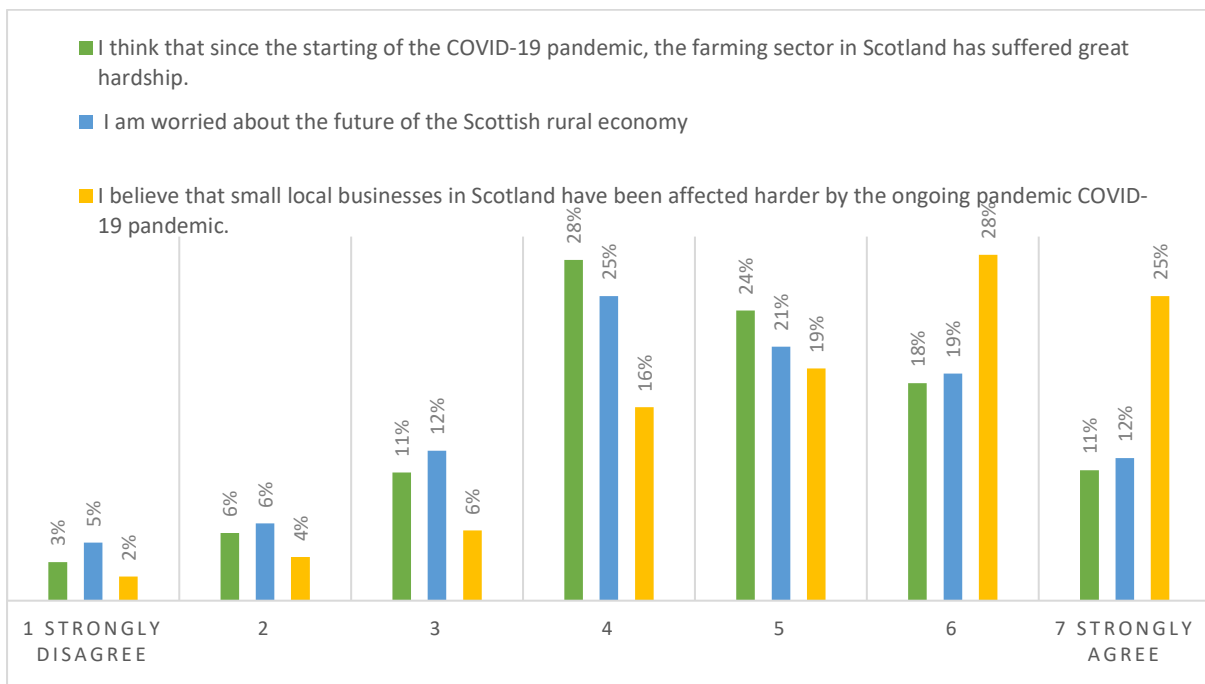


Figure 9. Impact on the rural economy or local food production



Measurement model

Model fit was assessed based on several indicators. A suitable model fit should provide an insignificant χ^2 (Kline, 2011). As expected, however, the χ^2 was significant – the chi-square test strongly depends on sample size and tends to reject the model (Corsini et al., 2018). Model fit was nevertheless deemed acceptable as the ratio of the chi-square test to the degrees of freedom was below 3, as recommended by Kline (2011) ($\chi^2/df = 2.7$). The model was also accepted based on the following fit indices. The RMSEA of the model was 0.08, which is in the acceptable range of $0.05 < RMSEA < 0.08$, and the SRMR value of 0.083 was well below the 0.10 threshold for acceptability (Weston and Gore, 2006). The CFI (Comparative Fit Index) and the Tucker-Lewis Index (TLI) are both 0.9.

Internal construct validity was assessed through Cronbach's Alpha and the Average Variance Extracted (AVE), which are reported for each indicator in Table 2. Value for Cronbach's Alpha range from 0.71 to 0.96. All AVE values were above the threshold of acceptability of >0.5 , apart from subjective norms, of 0.46. Because the indicator has been validated by the literature and is conceptually relevant, the constructs were kept in the model. All significant indicators had factor loadings >0.5 .

Table 2. Confirmatory factor analysis

Constructs	Indicators	Factor loadings	Cronbach Alpha	AVE
Risk Attitude	Are you generally a person who is willing to take risks, or do you try to avoid taking risks?	0.54	0.79	0.57
	Attitude towards risk - When purchasing food and drinks	0.89		
	Attitude towards risk - When consuming food and drinks	0.92		
	Attitude towards risk - Regarding my health	0.59		
Media influence	Watching TV news influences my awareness of COVID-19	0.79	0.71	0.56
	Reading the news influences my awareness about COVID-19	0.81		
	Social media influences my awareness about COVID-19	0.65		
Risk perception Covid 19	I think COVID-19 is a serious threat to my family and me	0.83	0.74	0.56
	I am afraid of the COVID-19 epidemic	0.85		
	I think I am likely to be infected with COVID-19	0.52		

Perceived Behavioural control	I have had complete control over the range of food products that I buy for my household.	0.71	0.88	0.66
	Purchasing food products has been easy	0.82		
	I have been able to buy the food products I want.	0.87		
	I have been able to find all the food products in the shops where I usually buy food	0.83		
Supply chain trust	I believe that British food retailers are implementing adequate measures to protect consumers	0.81	0.83	0.56
	I trust British/Scottish food regulators (e.g. Food Standards Agency)	0.86		
	I believe that the Scottish Government has been implementing adequate measures to protect my health	0.58		
	I have complete confidence in the safety of the food products I buy	0.71		
Subjctive norms	It is important to me what my friends think about the risks associated with food products during the COVID-19 pandemic	0.79	0.73	0.49
	It is important to me what my family members think about the risks associated with food products during the COVID-19 pandemic	0.71		
	It is essential that people who are important to me are happy with my food purchasing behaviour during the COVID-19 pandemic	0.58		
Perception food securiy staus	During the COVID-19 pandemic, I was worried (at least once) that I would run out of food because of a lack of money or other resources	0.86	0.90	0.77
	During the COVID-19 pandemic, I had to live (at least once) on a few kinds of food products because of a lack of money or other resources	0.87		
	During the COVID-19 pandemic, there was a time when you were hungry but did not eat because of a lack of money or other resources	0.91		
Atitude towards local and rual economy	I think that since the starting of the COVID-19 pandemic, the farming sector in Scotland has suffered great hardship.	0.73	0.74	0.50

	I am worried about the future of the Scottish rural economy	0.77		
	I believe that small local businesses in Scotland have been affected harder by the ongoing pandemic COVID-19 pandemic.	0.60		
Change consumption confort/convenient food	Compared to before Covid 19 crisis, I have used more ready-to-eat foods.	0.79	0.90	0.64
	Compared to before Covid 19 crisis, I have used more frozen foods.	0.73		
	Compared to before Covid 19 crisis, I have purchased more snacks.	0.81		
	Compared to before Covid 19 crisis, I have purchased more sugary drinks.	0.85		
	Compared to before Covid 19 crisis, I have purchased more sweets and desserts.	0.82		
Change food waste behaviuor	Compared to before Covid 19 crisis, I have thrown away more food because it passed its "best before" date	0.92	0.96	0.85
	Compared to before Covid 19 crisis, I have thrown away more food leftovers	0.92		
	Compared to before Covid 19 crisis, I have thrown away more food because of cooking more than what I need.	0.91		
	Compared to before Covid 19 crisis, I have thrown away more food because it passed its "use by" date.	0.93		

Structural model

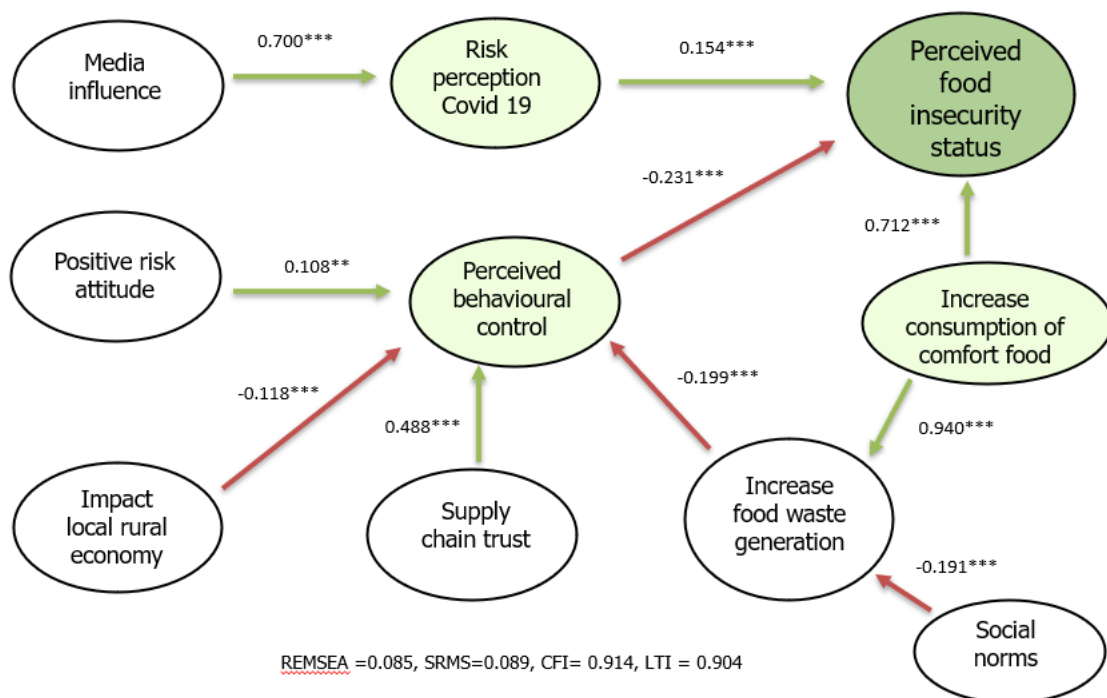
The results of the structural model are shown in figure 10. We could include several but not all the variables identified though our literature review. The end behaviour that we did model was the perception of food insecurity during covid 19 and which elements

We can observe that a higher level of risk perception regarding to covid-19 and an increase in consumption of comfort food have a positive and significant impact on the perceived food insecurity status. In line with the above relation a higher perception of control towards food purchase and consumption does have a negative and significant impact on the perceived food insecurity status. Furthermore, the bigger is the influence of the media on consumers awareness the higher is the perception of risk.

When considering positive attitudes towards risk and supply chain trust we can see that this have a positive and significant impact on the perception of control which we mention has a negative effect on the food insecurity perception. But worries about the impact on the local economy and an increase of food waste generation do have a negative impact on the perception of control towards food purchase and consumption.

Finally, we can see that increase on the consumption of comfort food has also been related positively and significantly with an increase of food waste generation. Finally social norms related to risks from food do have a negative impact on an increase on food waste generation.

Figure 10. Graphic Representation of the Structural Model with Standardised Regression Coefficients.



Conclusion

This study aims at identifying COVID-19 has altered food-related behaviours and food security perceptions among consumers in Scotland. We can see that respondents were conscious and worried about the risks of covid 19 and that they use written media and TV news to gather information regarding Covid-19. Those who feel more vulnerable to COVID-19 are more likely to feel more food insecure. In line with Mckendrick and Campbell, 2020 and Power et al., 2020. Traditional media play an important role in shaping risk perceptions associated with events such as public health crises. In line with Garfin et al., 2020; Harvey et al., 2001; Lobb et al., 2006; Smith, 2006; Taylor, 2019. Our respondents in contrast to previous results didn't report social media as relevant source of information.

The feeling of control regarding the capacity on deciding what food purchase during covid 19 is very high among respondents. Higher perception of control on our food purchase leads more positive attitudes towards food security. In line with Contini et al., 2020. This perception of control is positively

defined by trust on institutions and the food sector and negatively by those who concern about the local food sector and perception of an increased food waste generation.

Although the perception of being food insecure is low around 40% of responded worried at last once of not having enough food or not having enough diversity of food. This food insecurity is perceived food insecurity and increased is expectedly impacted by higher perceptions of risk and lower perception of food purchase control.

Respondents didn't reveal to change their food consumption behaviors towards comfort or convenience food and neither increased their food waste behavior.

References

Ajzen, I. (1991) 'The theory of planned behavior', *Organizational Behavior and Human Decision Processes*, 50, pp. 179–211. doi: 10.4135/9781446249215.n22.

Alfnes, F., Rickertsen, K. and Ueland, Ø. (2008) 'Consumer attitudes toward low stake risk in food markets', *Applied Economics*, 40(23), pp. 3039–3049. doi: 10.1080/00036840600994062.

Contini, C., Di Nuzzo, M., Barp, N., Bonazza, A., De Giorgio, R., Tognon, M. and Rubino, S., 2020. The novel zoonotic COVID-19 pandemic: An expected global health concern. *The journal of infection in developing countries*, 14(03), pp.254-264.

Costa-Font, M. and Gil, J. M. (2009) 'Structural equation modelling of consumer acceptance of genetically modified (GM) food in the Mediterranean Europe: A cross country study', *Food Quality and Preference*. Elsevier Ltd, 20(6), pp. 399–409. doi: 10.1016/j.foodqual.2009.02.011.

EFSA (2020) Coronavirus: no evidence that food is a source or transmission route. Available at: <https://www.efsa.europa.eu/en/news/coronavirus-no-evidence-food-source-or-transmission-route>.

Food Standards Agency (2020) FSA publishes guidance for consumers on coronavirus (COVID-19). Available at: <https://www.food.gov.uk/news-alerts/news/fsa-publishes-guidance-for-consumers-on-coronavirus-covid-19>.

Frewer, L. J. et al. (2002) 'Public preferences for informed choice under conditions of risk uncertainty', *Public Understanding of Science*, 11(4), pp. 363–372. doi: 10.1088/0963-6625/11/4/304.

Garfin, D. R., Silver, R. C. and Holman, E. A. (2020) 'The novel coronavirus (COVID-2019) outbreak: Amplification of public health consequences by media exposure', *Health psychology : official journal of the Division of Health Psychology, American Psychological Association*, 39(5), pp. 355–357. doi: 10.1037/hea0000875.

Gerhold, L. (2020) COVID-19 : Risk perception and Coping strategies . Results from a survey in Germany.

Harvey, J. et al. (2001) 'The relationship between attitudes, demographic factors and perceived consumption of meats and other proteins in relation to the BSE crisis: a regional study in the United Kingdom', *Health, Risk & Society*, 3(2), pp. 181–197. doi: 10.1080/13698570120051426.

Laville, S. (2020) 'Coronavirus offers chance to create fairer UK food supply chain, say experts', *The Guardian*, 18 May. Available at: <https://www.theguardian.com/environment/2020/may/18/coronavirus-offers-chance-to-create-fairer-uk-food-supply-chain-say-experts?fbclid=IwAR1gxxYEVf7cDD35eAcsbOJ7IoTqqwLTP5uMQbW7vDcpPDWOjRaoSDi7-gk>.

Lohiniva, A. L. et al. (2020) Understanding coronavirus disease (COVID-19) risk perceptions among the public to enhance risk communication efforts: A practical approach for outbreaks, Finland, February 2020. doi: 10.2807/1560-7917.ES.2020.25.13.2000317.

Lobb, A. E., Mazzocchi, M. and Traill, W. B. (2006) 'Modelling risk perception and trust in food safety information within the theory of planned behaviour', *Food Quality and Preference*, 18(2), pp. 384–395. doi: 10.1016/j.foodqual.2006.04.004

Mckendrick, J. H. and Campbell, S. (2020) Local action in Scotland to tackle food insecurity during the coronavirus crisis.

Miles, S. and Frewer, L. J. (2003) 'Public perception of scientific uncertainty in relation to food hazards', *Journal of Risk Research*, 6(3), pp. 267–283. doi: 10.1080/1366987032000088883.

Olstedal, S. and Rundmo, T., 2006. The effects of personality and gender on risky driving behaviour and accident involvement. *Safety science*, 44(7), pp.621-628.

Pautz, H. and Dempsey, D., 2022. Covid-19 and the crisis of food insecurity in the UK. *Contemporary Social Science*, pp.1-16.

Power, M. et al. (2020) 'How COVID-19 has exposed inequalities in the UK food system: The case of UK food and poverty', *Emerald Open Research*, 2, p. 11. doi: 10.35241/emeraldopenres.13539.2.

Slovic, P., 1987. Perception of risk. *Science*, 236(4799), pp.280-285.

Smith, R. D. (2006) 'Responding to global infectious disease outbreaks: Lessons from SARS on the role of risk perception, communication and management', *Social Science and Medicine*, 63(12), pp. 3113–3123. doi: 10.1016/j.socscimed.2006.08.004.

Taylor, S. (2019) *The Psychology of Pandemics - Preparing for the Next Global Outbreak of Infectious Disease*.

Tonsor, G. T., Schroeder, T. C. and Pennings, J. M. E. (2009) 'Factors impacting food safety risk perceptions', *Journal of Agricultural Economics*, 60(3), pp. 625–644. doi: 10.1111/j.1477-9552.2009.00209.

Wansink, B. (2004) 'Consumer Reactions to Food Safety Crises', *Advances in Food and Nutrition Research*, 48, pp. 103–150. doi: 10.1016/S1043-4526(04)48002-4.

WHO (2020) Coronavirus disease 2019 Q&As - Questions relating to consumers. Available at: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/question-and-answers-hub/q-a-detail/questions-relating-to-consumers>.

Whitworth, E., Druckman, A. and Woodward, A. (2016) 'Food scares: a comprehensive categorisation', *British Food Journal*, 119(1), pp. 131–142. doi: 10.1108/BFJ-06-2016-0263.

Yamoah, F. A. and Yewson, D. E. (2014) 'Assessing Supermarket Food Shopper Reaction to Horsemeat Scandal in the UK', *International Review of Management and Marketing*, 4(2), p. 98107.

Yeung, R. M. W. and Yee, W. M. S. (2005) 'Consumer Perception of Food Safety Related Risk: A Multiple Regression Approach', *Journal of International Food & Agribusiness Marketing* ISSN:, 17(2), pp. 195–211. doi: 10.1300/J047v17n02.