Food and Nutrient Security: Model of Decision Making under Information Uncertainty

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Abstract: Decision-making under uncertainty continues to be an active area for research, with political implications within the food industry, particularly in the EU. However, these attitudes and behavior patterns are not specific to the current situation. Following the integration of attitudes into a model, more rational decision-making has been increasingly used. The aim of this study was to survey: How attitudes toward food and nutrient security influence decision making under unclear information. A questionnaire collected data from 910 students in the Czech Republic. An ordered regression model was developed for ordinal dependencies as well as independent variables. The model used for this survey estimated the attitude spillover-effect on behavior under information uncertainty. It is evident from the survey that clear information and awareness of global issues related to food are needed. Changing human behavior is not about knowledge, but rather about the opportunity to make significant alterations in human thinking. This data may guide the critical issues concerning clear information on food origin within the Czech Republic for a project from the European Union.

Key words: Perceived Uncertainty · Decision-Making · Attitudes · Spillovers Effect

JEL Classification: D12 · D71 · D81

1 Introduction

Incorporating cognition, attitudes in consumer decision-making behavior still remains an unclear area of research with political implication upon the food industry. While there are several reasons for a revision of the neo-classical rational theory, we focus expansive research on attitudinal and behavioral patterns consistent with the hypothesis attitudes to food and nutrient security which have had a significantly larger impact on decision making under information uncertainty. Most studies provide evidence that attitudes toward food and nutrient security influence consumer behavior, both in Europe (Grunert, 2005; Verbeke, 2005; Vermeier & Verbeke 2006) and in the context of less developed countries (Bosman at al. 2012). Several experiments demonstrate even stronger evidence that attitudes have an impact on decision-making behavior (Robinson & Smith, 2002; Zepeda & Leviten-Reid, 2004; Bell & Marschal, 2003; Chen & Huang, 2013). These revisions of theory suggest integrated attitudes into a model of rational decision-making behavior. Or, as Li at all. (2013) concludes, that the effects of cognition and emotion varies with the levels of uncertainty to a decision-making behavior, specifically in China. In fact, a series of findings indicate that the prominent position of decision-making under uncertainty has an emotional influence. Hence, the aim of this study is associated with research question: How attitudes toward food and nutrient security influence decision making under unclear information. The European Union established a project to examine relevant issues impacting the agro food sector. The objective includes mapping the current situation and producing guidelines on critical issues concerning clear information on food origin. In order to achieve a comprehensive picture of the situation in the Czech Republic, a questionnaire is consistent on prediction behavior patterns under information uncertainty with different levels of attitudes on food and nutrient security.

1.1 Types of information

Information types are considered using the typology of search, experience (Nelson, 1970; Stigler, 1961) and credence (Darby & Karni, 1973) in the literature on information economics. Search characteristics are those that can be recognized before purchase. Experienced characteristics can be ascertained after purchase. Credence characteristics not detected at all, even after using the product (Andersen, 1994). Is not at all clear what other information consumers find on values derived from what they get. To solve that issue conceptually, Becker & Tilman (2000) distinguished between product characteristics and product attributes. The information concerning product attributes consumers have during shopping and consumption refers as cue. The other approach, mostly purchases made under uncertain quality is divided among intrinsic and extrinsic cues. Intrinsic may include any food characteristics inherent in the product itself, whereas extrinsic cue is not fundamental to the product. Studies have often shown that cue has both an direct and indirect effect

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on attitude (Van der Lans et al., 2001). The most reported is an indirect effect on consumer attitude towards a product, such as locally-grown, fresher, environmental issues and safety. In conclusion, this approach provides guidelines on the critical issue of information on decision-making behavior. Recent research suggests that cue significantly reduces information uncertainty when consumers feel confident about them. But Cox (1967) pointed out that, in the current situation on the market, consumers feel confident in using cues they believe to predict quality, even though they are not clear.

1.2 Decision-making: Attitude and intention

The behavior model introduced by the theory of attitude formation serves as the basis for a conceptual framework to investigate the specific effects from attitudes varying with the level of the behavior of consumers, where there is information uncertainty (see Figure 1). Numerous studies employing this method have been reported in the food market (Vermeir & Verbeke, 2006; Denton, 2009; Chen & Huang, 2013). The theory of attitude formation was developed in psychology (Fishbein, 1967; Fishbein & Ajzen, 1975).

![Figure 1](Attitude Behavioral intention)


2 Methods

2.1 Data collection

The questionnaire based on research by Consumer Interest Alliance Inc. (2007) and was developed by a focus group. The questionnaire was collected at the Universities (330 from University of Czech Life Science in Prague, 300 from University of South Bohemia in České Budějovice, 340 from Mendel University in Brno, 200 from Masaryk University, 200 from School college in České Budějovice, 80 from School college in Benešov). For the purpose of survey was used part of responds. All respondents were responsible for cheese purchase. The sample is not statistically representative of younger and better educated students among the Czech population. A survey was developing to collect attitudinal and behavioral patterns under information uncertainty.

Each respondent was asked (a) when are you selecting a new cheese product, do you generally, purchase a product if the information on the product label is not easy to understand? The consumer scored on a level using four choices – one being never, the second rarely, third sometimes and four always; (b) to the question of how important is the following information to you? For each cue (1) Origin of milk; (2) Safe food handling, (3) Ingredients), the student scored level 1 being unimportant, 2 important and 3 very important.

Consumer attitude (e.g. interest in cue) was measured by assessing “importance to you” (Table 1). Importance was measured on a 3-point rating scale. Intention of behavior was measured on a 4-point interval rating frequency of behavior. The first indications pertained to origin: the milk of origin as part of the phase of the regulation EU No 1151/2012 of the European parliament and of the Council on quality schemes for agricultural products and foodstuff to improve the authenticity of local product. The next included ingredients in products and safe food handling, which are mandatory government-regulated and standard information cues. Safety is one of the food product attributes that can be used by consumers in their evaluation of product alternatives and their formation of quality expectations, argues Verbeke (2005). The analysis was first focused on the cue, then on behavior intention.

2.2 Description of the model

Students scaled their level or frequent decision-making under unclear information. Let $Y_i$ denote the intention of behavior “$i$” letting $i=0$ meaning never buy, option 1 meaning rarely, 2 sometimes and 3 always. Note that the purpose of this numeric does not have unit measurement, and that expectations, etc. are not included. Furthermore, the model for multi-numerical data is inefficient, since they ignore the ordering information. The linear regression model cannot be appropriate either, due to the implicit assumption of an interval scale, as pointed out by Winkelmann & Boes (2006). While we introduce econometric models that take into account ordered responses, we consequently use ordered probit regressions to explore the relationship between decision-making information uncertainty and human thinking concerning food and nutrient security. There are several models for ordinal outcomes, which are used in micro-economic theory. The model for ordered dependent variables are an underlying continuum by latent variable $Y_i^*$ using the structural model as shown in Eq. 1.

$$Y_i^* = x_i' \beta + \epsilon_i$$

(1)
The vector $x_i$ is a set of $K$ covariates that are assumed to be strictly independent of $\varepsilon$, $\beta$ a vector of $K$ parameters. Where $\varepsilon$ has mean zero and follows a symmetric distribution (i.e., normal). We cannot observe the latent continuous variable $Y^*$, with discreet values. Since the score is an ordered ranking but still a binary measure, the equivalence is based on the following relationship between the observed discrete response and the continuous latent variable $Y^*$ is observed in discrete form through a censoring mechanism (Greene & Hensher, 2008). The predicted probability of a behavior is the area under the function between a part of cut points as given frequency of the behavior.

The marginal effect is at the point between the start and finish of the function. The model is estimated using probit analysis to control for different effects and to examine the attitudes and behaviors patterns. The basic form of the model is: Buy, if information is uncertain, $=f(\text{attitudes to information as a cue on new products})$.

First, we estimated the linear function of the behavior as independent variables and a set of cut-points. The cutpoints are coded $\kappa_0$, $\kappa_1$, $\kappa_2$. We used each attitude on information to predict the behavior as an ordinal independent variable, defined simply as a set of mutually exclusive states that are ordered in terms of the characteristic of interest. We will attempt to draw focus to an attitude concerning in food and nutrient security such as predictors of the models. We tested whether attitudes are significant and fit of measure.

Second, we focus on predicting human behavior under information uncertainty, with to differentiation of attitudes on food and nutrient security. In the ordered probity regression model, the probability of a particular outcome is determined by the area under the density function between relevant thresholds. This means that the probability of behavior corresponds to the probability that the estimated linear function, plus random error, is within the area of the cutpoints estimated for the variation of behavior (Eg. 2), where $F()$ is standards normal distribution $F(u) = \Phi (u)$. The model provides predictors of each level of behavior for the low attitudes of food and nutrient security for our purpose only unimportant level of attitude. Hence, the discrete probability effect for all level of attitudes is defined Eg. (2). Following the distributional assumption at the error terms yields the conditional possibility function of the latent variable, $f(Y_i=j|X_i)$.

$$P(Y_i=j|x_j) = \begin{cases} 0 \Rightarrow \text{never buy if } Pr(y=0) = F(\kappa_0 - X\beta); (y^* \leq -0.82) \\ 1 \Rightarrow \text{rarely buy if } Pr(y=1) = F(\kappa_1 - X\beta) - F(\kappa_0 - X\beta); (-0.82 \leq y^* \leq 0.13) \\ 2 \Rightarrow \text{sometimes buy if } Pr(y=2) = F(\kappa_2 - X\beta) - F(\kappa_1 - X\beta); (0.13 \leq y^* \leq 1.60) \\ 3 \Rightarrow \text{always buy if } Pr(y=3) = 1 - F(\kappa_2 - X\beta); (y^* \leq 1.60) \end{cases}$$

(2)

Third, the data analyst probability should search for an elegant and concise method. When approximately linear, the marginal effect can used to summarize the effect of changes in attitude toward food and nutrient security on the probability of each level of behavior. The marginal probability effect ($MPE$) of the $l$-th element in $x_i$ (Eq.3) and can be obtained in general form from equation (2), by taking first derivatives, as stated by Winkelmann and Boes (2006). We compare the probability for low level of attitudes with marginal probability effect.

$$MPE_{ij}=\frac{\partial}{\partial x_{ij}} f(\kappa_j - X\beta) = f(\kappa_j - X\beta) \beta_j$$

(3)

3 Research results

More than 910 questionnaires were distributed in fall 2009 and all were returned. Probably due to first sentences in the part of introduction: Cheese imports reached 64 277 tones in 2009 which represent 42.8% share in consumption. Before answering the entire questionnaire we introduce them about the purpose of survey and then we ask to eat cheeses pending. Subsequently questionnaire were framed into electronic formulas (in google) and used to analyze data in statistics program. In the second part of survey was presented the Common Agriculture policy at the secondary school. From analysis we used only 910 data from the University. Of the 910 youngsters following higher education in the age group 20 -24, 595 were female (65%). Data analysis methods included ordered probit models. First, we tested whether attitudes toward cues influenced behavior. Students who have positive attitudes toward global issues focused on milk origin, safe food handling and ingredients in the product. They tended to be associated with a high level of uncertainty to buy a new product ($p<0.10$).

Mean intention for buying a new cheese product if the information on the product label was not clear was 1.09 on a 4-point scale. Mean attitude toward ingredients in the product was 1.12, while mean attitude toward safe food handling was 0.83 and origin of milk was 0.78, all on a 3-point scale. Majorities of consumers have either a high attitude towards global food issues and high levels of decision making under uncertainty or low attitudes towards global issues and low levels of uncertainty, in line with consumer behavior. However, also a considerable amount of students have
In other words, changes of attitude have a higher effect on probability in the buy product with clear information category than in sometimes and never. We estimated the attitude spillover effect in the form of a move from the probability category of buying product with unclear information (-sometimes) into the category of buying the product with clear information. Findings from this survey may aid policies in their development and implementation of a transparent system for clear information concerning food origin. Second, the effect of medium and low interest is negative and then positive. At the end of our analysis, being unclear about information for milk of origin or ingredients or safe, healthy food produces a very high probability of never or rarely buying (56%) (in the level of unimportant). On the other hand, the probability in levels behavior is similar, as the level of important increases the probability from 21% as unimportant and the probability form 42% as very important.

This is the first detailed survey of the attitudes and behavior patterns under information uncertainty in the Czech Republic. The result reported using ordered model significant relationship between attitudes and behavior. This is of particular relevance. In addition microbiological quality and food security give couples the opportunity to make informed decision making. The general is that there is sufficient evidence to support clear information related to food in all the supply chain system. This reflects number of research findings. Some important sources of information about antimicrobial resistance, which are occurring in food, come from researchers in veterinary and human medicine. Their experiment is focused on methyI-resistant Staphylococcus aureus (MRSA) and extended-spectrum beta-lactamases. In the last decades has been proven, that the bacteria can affect both animal and human dermatitis, arthritis, pneumonia etc. The study shows, why is attention to strategies ensuring antimicrobials resistance along the food chain, why accepted complex solution in the countries not only in European Union is. Analysis of regulation on imported food in the microbiological quality shows that it is affected at the least two requirements of food control. At the time prevailing consensus option, that one of these requirements is related to food hygiene, the second is related to food related diseases. Method of controlling the requirement is not possible to simply identify if we require the interpretation from the Federal Ministry of Food and Agriculture in the Germany. The strict requirements regarding food apply in the whole of Germany as well as in the European Union. It applies, that microbiological quality is various across country. The increasing awareness of consumers on food security and the potential risk associated with food production and technologies people are more interested in issues of local region, local producers (Henson, 1996) Additionally, people are afraid to use chemicals in food production as well as in their local area (Tilmany at all., 2008). This is a reason why uncertainty and perceived difficulty in evaluating quality increases consumer use of extrinsic the quality cue (Bredahl, 2004; Verbeke, 2005; Zeithaml, 1988) and changes behavior. As compare with many other studies, the traceability system plays a key role in purchase intentions (Chen & Huang, 2013). Chen, Huang focused on the relationship between perceived uncertainty and purchase intention to consume fast foods, offered by stores adopting the Food Traceability System in Taiwan. They reported that when a fast food store adopts the Food Traceability System, then realized that uncertainty can be reduced, because both their perceived information asymmetry and fears of seller-opportunism are also reduced, thereby strengthening their purchase intentions. It is evident from the survey that clear information and awareness of global
issue related to food are needed. Changing human behavior is not about knowledge, but rather about the opportunity to make significant alterations in human thinking.

Figure 2 Marginal effects of attitudes on decision-making under uncertainty

Source: Own processing (2012)

4 Conclusions

In this article, we have estimated probability model where marginal change attitudes affect purchase decision-making under information uncertainty. The model used for this survey estimated the attitude spillover-effect on behavior under information uncertainty. However, some conclusions can be drawn regarding factors that might impact on behavior, as determined by the various level of attitude. Some clear relationships are evident from probability analysis, most notably that different attitude of microbiological and food security. It is difficult to ascribe effect to these relationships. However, higher attitude increase probability in category to never buy at the same time decrease probability in the category rarely to buy. A questionnaire collected data from 910 students in the Czech Republic. Significant relationships exist. Attitude to information change has both an explanatory and a predictive function of attitude change has then been related to a change in the direction of demand for quality (environmental, as well as sustainability) foods. Therefore we would concluding of the change in attitudes had contributed to our understanding of the increase in demand. These data may guide the critical issues concerning clear information on food origin in the Czech Republic for project from European Union. It is likely to have another though that uncertainty is in the minds and souls of the customer and a kind of analysis offered here is more suitable for reliability study. Although this viewpoint cannot be refuted in totality, this analysis based on the scientific principles of probability, have greater extent of validity.

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