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Investigating individual preferences in rating and ranking conjoint experiments. A case study on semi-hard cheese

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ABSTRACT

Stated preference conjoint experiments and self-explicated measures based on rating and ranking approaches were conducted to investigate Norwegian consumers' choices among healthier and organically produced semi-hard cheeses. In the conjoint experiments, one group of participants (n = 114) performed a rating task of eight cheeses whereas the other group (n = 105) performed a ranking task of the same cheeses, all based on pictorial stimuli only. Then, all participants performed self-explicated rating and ranking evaluations of the cheese attributes. Conjoint rating data were analysed by mixed model ANOVA, while conjoint ranking data were analysed by mixed logit. The different approaches are compared in terms of data analysis methodologies, outcomes and practicalities for the experimenter as well as for the respondents. Rather than average population effects, focus is brought on individual preferences and consumer segmentation. Findings reveal that the two conjoint experiments lead to similar population effects and consumer segments. Consumers on average prefer cheeses of new (healthier) fat composition, organic production and lower price to cheeses of regular fat composition, conventional production and higher price. Two consumer segments are investigated. Consumers in the New fat segment are health-conscious, whereas consumers in the Regular fat segment are attracted by conventional cheese and lower prices. Self-explicated ratings of the cheese attributes corroborate these findings.

Introduction

Experimental approaches are widely used to study consumer responses to food products. A first level of research on consumer experimental methods concerns the selection of a methodology, comparing for example experimental auctions to conjoint studies (Grunert et al., 2009; Sichtmann & Stingel, 2007), or combining such methods (Combris, Bazoche, Giraud-Heraud, & Issanchou, 2009). A second level of research concerns possible options within one methodology. This paper addresses the latter by comparing an acceptance rating test to a preference ranking test in a conjoint study on generic unbranded semi-hard cheese. More specifically, focus is brought on modelling strategies with regard to the different nature of rating and ranking data. As preference heterogeneity is a very relevant and natural element of food choice research, described as "a key and permanent feature of food choices" (Combris et al., 2009), emphasis is made on studying inter-individual preference variations and consumer segmentation. Further, conjoint experiments may often be complex to design, time-consuming to perform and costly to carry-out (Sattler & Hensel-Börner, 2003). A second aspect of this paper is thus to compare conjoint approaches with self-explicated approaches, where the consumer is plainly asked about preference levels for a product's attributes (Sattler & Hensel-Börner, 2003).

Rating and ranking scales

Several rating and ranking scales have been developed and are commonly used in consumer testing (Hein, Jaeger, Carr, & Delahunty, 2008). We will here focus on the types utilised in the present conjoint study: acceptance rating with a 9-point category scale ranging from 1 to 9, and preference ranking with no ties allowed (forced choice). In acceptance rating, consumers evaluate each product separately and rate these according to their degree of appreciation. Rating generates an indirect measure of product distances. In preference ranking, consumers order products according to their preferences from best to worst. Ranking involves performing a succession of product choices where the consumer

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is forced to discriminate between products, but no information regarding the degree of appreciation is obtained (Hein et al., 2008). Rating and ranking methods have previously been compared in a number of studies (see e.g. Hein et al., 2008; Kozak & Cliff, 2013; Lagerkvist, 2013; Villanueva, Petenate & Da Silva, 2000, 2005), often with a general focus on mean population results comparisons. In a comprehensive method comparison study, Hein et al. (2008) tested five common acceptance and preference methods based on rating and ranking approaches: 9-point hedonic scale, labelled affective magnitude scale, unstructured line scale, best–worst scaling and preference ranking. Their main finding is that all five methods lead to the same conclusions regarding the products, with slight performance differences observed in product discrimination power, ease of use and perceived accuracy in favour of the best–worst scaling method. However these authors worked with hedonic tests involving real food stimuli and the results may not necessarily generalise to other contexts, such as pictorial stimuli in a web-based survey. Further, their study neither investigated conjoint factors, nor compared the different methods in terms of consumer segmentation. These issues will be addressed in the present paper in the case of two rating and ranking approaches.

Self-explicated and conjoint approaches

Self-explicated approaches consist in testing consumers' attitudes or preferences for product attributes by directly asking about the attributes rather than presenting products. Such approaches are often seen in comparison to conjoint methods, which by using a complex design setup aim at collecting more reliable data than self-explicated measures. Among other, it is believed that conjoint methods increase the similarity to real choice situations and decrease the risk of collecting socially acceptable answers (Sattler & Hensel-Börner, 2003). Sattler and Hensel-Börner (2003), however, report that studies that compare conjoint and self-explicated measures generally conclude that their performances are either equivalent, or different in favor of self-explicated measures. It is therefore interesting to study how these methods compare to each other when studying stated preferences for food choices.

Data analysis

Acceptance rating tests generate (nearly) continuous data, whereas preference ranking tests generate ordinal, discrete data. Accordingly, in conjoint experiments with rating scales the population effects from consumers' evaluations are typically analysed by mixed model ANOVA (ANalysis Of VAriance), that is to say an ANOVA model combining fixed and random effects and usually assuming normal distributions for the random parts (Næs, Brockhoff, & Tomic, 2010a). In practice, ordinal measures can be approximated to continuous measures, such that ANOVA is also frequently used on ranking data even though this method is not designed for discrete data (Villanueva, Petenate, & Da Silva, 2000, 2005). One must, in particular, be aware of the fact that the ranks are highly dependent on each other in small studies and the assumptions underlying standard ANOVA may be strongly violated. More appropriately, in the field of econometrics ranking data and other choice-based data are routinely analysed by so-called discrete choice models. Discrete choice models aim at understanding the behavioural process that leads to a consumer's choice (Train, 2009). The approach consists in modelling Utility, that is to say the net benefit a consumer obtains from selecting a specific product in a choice situation. These models emerged in the 1970s and have undergone a rapid development from the original fixed coefficients models such as multinomial logit, to the highly general and flexible mixed logit, also called Random Parameter Logit (Ortúzar, 2010). Mixed logit is an advanced discrete choice model where one may freely include random parameters of any distributions and correlations between random factors. This flexibility allows writing models that better match real-world situations. By including random parameters, mixed logit intrinsically models preference heterogeneity, i.e., inter-individual preference variations. Further, mixed logit acknowledges the fact that any food choice decision in the experiment, in this case any product ranking, may be dependent on the consumer's previous decisions. Even though discrete data is common in sensory and consumer science, there is no tradition in sensometrics for mixed logit, which was recently introduced to the field by Barreiro-Hurlé, Colombo, and Cantos-Villar (2008), Jaeger and Rose (2008) and Ortúzar (2010). We refer to the latter for a sound introduction to the mixed logit model and to Train (2009) for a comprehensive description.

Following the study of mean population effects, a study of preference heterogeneity is often required to identify trends within subgroups of the consumer sample. Various methods of consumer segmentation may be applied, such as clustering algorithms, visual segmentation based on Principal Component Analysis (PCA) (Almli et al., 2011) or fuzzy clustering (Johansen, Hersleth, & Næs, 2010; Næs et al., 2010a; Westad, Hersleth, & Lea, 2004). It is also possible to induce segments in a latent class model (Hess, Ben-Akiva, Gopinath, & Walker, 2011; Mueller, Lockshin, Saltman, & Blanford, 2010) or in a clustering around latent variables model (Vigneau, Endrizzi, & Qannari, 2011; Vigneau, Qannari, Punter, & Knoops, 2001). Beyond the selection of a statistical approach, there are two main strategies to choose from when addressing clustering purposes: one may either create consumer groups of similar background such as gender, income, attitudes or purchase habits, or create consumer groups of similar product preferences. The first strategy is sometimes called *a priori segmentation* (Næs et al., 2010a) and is based on splitting the consumer group into segments according to consumer characteristics and analysing the group preferences separately or together in an ANOVA model. The second strategy is based on analysing the actual preference, liking or purchase intent data to create segments, then relating segments to consumer characteristics *a posteriori*. In the present paper the second strategy will be used. To perform consumer segmentation based on individual acceptance ratings, a multi-step approach introduced by Næs et al. (Næs, Lengard, Johansen, & Hersleth, 2010b; see also: Endrizzi, Menichelli, Johansen, Olsen, & Næs, 2011; Endrizzi, Gasperi, Rødbotten, & Næs, 2014) is applied. To perform consumer segmentation in the case of preference ranking, a new approach is presented based on individual model estimates from mixed logit and inspired by the method in Næs et al. (2010b). In both cases, segmentation will be done based on visual interpretation of PCA plots of the individual differences. The main advantage of such an approach is that one can decide on which segments or groups of consumers one is interested in studying. Another argument for such an approach is that using different automatic clustering methods can give quite different results, and also results which are difficult to interpret in terms of samples tested (see Endrizzi et al., 2014).

Objectives

The data presented in this paper are extracted from a large conjoint experiment conducted in Norway in 2009 investigating the effect of health information on consumers' diet choices (Øvrum, Alfnes, Almli, & Rickertsen, 2012). In the present paper, only the control group of participants who did not receive health information are utilised. In particular, the study investigates consumer's willingness to buy full fat vs. low fat cheese and cheese of regular fat composition vs. new fat composition, which includes a higher unsaturated fat/saturated fat ratio. The factor corresponding to a