Attribute Non-Attendance and Consumer Preferences for Online Food Products in Germany

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Abstract

In this article, we apply a choice experiment method to examine consumers' preferences for online food product attributes, using survey data for German consumers for meat products. We use both mixed logit and latent class models to analyze preference heterogeneity and sources of heterogeneity, as well as endogenous attribute attendance models to account for consumers' attribute processing strategies. The empirical results reveal significant heterogeneity in preferences for online meat attributes among consumers. We also find that consumers' willingness to pay estimates are highly influenced by their attribute processing strategies.

Key Words

online food attributes; choice experiment; preference heterogeneity; attribute non-attendance

1 Introduction

Although the online food sector in Germany is currently a niche with a market share of about 1%, many big players of the food retail industry such as REWE, as well as online retailers like Amazon are launching online food retail channels (HDE, 2017). In particular, the annual growth rate of the revenue of the online food sector increased to 21.2% in 2016, compared to 10.4% for the non-food sector (HDE, 2017). A survey in 2017 revealed that about 25% of German consumers would be willing to purchase all their groceries online (STATISTA, 2017). In spite of massive growth in the small sector, many German consumers still remain skeptical about buying their food online, since the traditional (offline) food retail market allows about 50% of the consumers to do their grocery shopping within a walking distance from home, which meets their desire for convenience shopping (BMEL, 2017a; DELFMANN et al., 2011).

Another important component of the modern food retail industry is consumers' interest in responsible and sustainable production processes, as well as the health impacts of consumption. For a growing proportion of the population, social responsibility, environmental protection, animal welfare, transparency or knowledge about food ingredients play an increasingly important role with regards to their values and attitudes towards food items (e.g. ZANDER and HAMM, 2010; KAYSER et al., 2012; BUSCH et al., 2013; BECHTOLD and ABDULAI, 2014; HEISE and THEUVSEN, 2017). In the food market, these attributes are mostly represented through organic or similar labels that tend to express certain quality standards in the context of social or environmental sustainability. However, these products are usually more expensive than conventional products, resulting in lower demand for the products relative to the conventional variant. The higher prices for these products of a specific quality are largely due to marketing and distribution costs (e.g. KORBUN et al., 2004; BRAVO et al., 2013; BUDER et al., 2014). Direct marketing through online retailing reduces transaction costs and allows the supply of products with these specific attributes, even in small quantities to consumers (e.g. SINGH, 2004). However, the adoption of new technologies, and products by consumers usually occurs over time and not immediately. When and to what extent products or technologies are adopted is rather subject to attitudes and characteristics of the members of different consumer groups. As argued by SWAIT (1994), preferences are indirectly affected by attitudes through the latent segment to which the consumer belongs, and as such attitudinal data are quite important in explaining choice behavior. SWAIT (1994) further argues that these latent groups describe the differing degrees of sensitivity of heterogeneous consumers to certain product attributes. A major objective of this study is therefore to determine if consumers or specific groups of consumers are willing to use modern information technology (IT) to gain more utility, by purchasing

certain food items using online retail channels. The online retail sector for fresh food is, as mentioned earlier, still at a very early stage of its development and its acceptance by the majority of consumers in Germany remains relatively low. Nevertheless, some consumers might be interested in exceptional concepts or new technologies, and their ideals and values might differ from those of the majority or other specific groups. For instance, some consumers prefer online shopping due to its convenience characteristics such as time saving potentials or the avoidance of hectic shopping in crowded supermarkets (e.g. NIELSEN, 2016). Since these special characteristics cannot be generalized for all consumers, we assume the existence of preference heterogeneity.

Given the potential of online food retailing to transform the modern food industry and to create additional marketing channels, it is important to ascertain consumer preferences and the sources of these preferences. However, until today, only few studies have examined consumers' preferences for online food products (e.g. WARSCHUN et al., 2013, 2016; NIELSEN, 2016; MILLER et al., 2017; KIM DANG et al., 2018). In the present study, we focus on meat products (beef steaks, 200g) with high quality characteristics[1] for three reasons. First, online retailing provides direct marketing opportunities at potentially lower transaction costs for cattle farmers. Direct marketing also allows those producers to signal information on credence characteristics of their products to the consumers. Thus, online retailing is particularly promising for these products. Second, high quality food products are sufficiently unique and expensive, so that consumers spend time to select their preferred products based on their attributes. Third, the decision to select meat was guided by the fact that meat products are different from many other food products. They require a particularly sensitive handling (cooling, hygiene etc.) and they are often emotionally charged (animal welfare, trust). Thus, the present study contributes to the empirical literature by analyzing consumers' preferences for online retailing and fresh food products with high quality characteristics, using choice experiment (CE) data of 201 German consumers. We also contribute to the literature by including innovative transparency attributes into the CE.

Specifically, we first use a mixed logit (ML) model to analyze heterogeneity in preferences for fresh, high quality online food products. We then employ a latent class (LC) model to identify the sources of potential heterogeneity, as well as the willingness-to-pay (WTP) for the food products. To the extent that the recent literature on CE methods indicate that accounting for respondents' attribute processing strategy, which refers to the level or order of recognition of the attributes or the creation of heuristics in the decision-making process, is of significance for market share predictions and welfare estimates (HESS and HENSHER, 2013; BELLO and ABDULAI, 2016), we also use a LC structure to address the issue of attribute non-attendance (ANA). This phenomenon refers to the fact that respondents tend to simplify choice tasks by excluding certain attributes from their decision-making processes, which may lead to biased coefficient estimates (e.g. HENSHER, 2006). Analyzed preferences, attribute attendance strategies and resulting WTP allows producers to evaluate their potential to promote direct marketed products (BELLO and ABDULAI, 2017). The sector can thus focus on specific attributes to create products and precise advertisement that gain the attention of specific consumer groups who are willing to pay for these products.

The rest of the paper is structured as follows. The next section discusses the background of online retailing in Germany and presents the related literature. Section three outlines the conceptual framework used in the analysis, while section four presents the survey design. The empirical results are discussed in section five, and the final section presents conclusions and implications.

2 Background

A fundamental problem for providers of internet-based food shopping systems in Germany is the satisfaction of the consumer with the status quo. A study by DELFMANN et al. (2011) shows that about 73% of the respondents are completely satisfied with the stationary purchasing situation and do not seem to gain any additional utility by using online food services. At the same time, the authors emphasize a heavy price-based competition in the German food retail sector,

[1] In the following, the term "*high quality*" refers to the fact that the products offered in the experiment are able to meet the above and in section 2 mentioned values of certain / some sustainability categories which nowadays – at least partly – determine consumers' shopping and decision-making behavior. The term does not refer to a certain level of any analytical constituent. It simply describes the fact that products presented in the choice experiment might be able to meet a specific level of consumer desire perfectly.

which makes it difficult to transfer additional costs of the new services (e.g. high shipping costs due to exact timing, hygienic standards and special transportation vehicles) to the consumer. Furthermore, when ordering online, uncertainties regarding the quality of fresh products, which are selected and delivered by an unknown third party, may arise. These uncertainties can increase, as food items already have inherent attributes that make them credence goods (e.g. KOESTER, 2016). Moreover, the dependence on trust structures can be further enhanced by the fact that the choosing process is left to another person. According to DELFMANN et al. (2011), busy consumers of younger generations, whose highly qualified professions make their own free and recreational time valuable or young parents should be the main target groups for a potential online food market.

By bundling different assortments and product groups, food retailers provide the consumer with a considerable reduction in transaction costs[2] (HDE, 2015). However, the fact that information about certain search goods can be used infinitely by any market participant, without reducing the utility of other market participants, enables digital or internet technology to significantly reduce transaction costs through time- and location-independent provision of information of all kinds (e.g. BAKOS and BRYNJOLFSSON, 2000). The simplified dissemination of information about products and services on the market can entail a reduction in the cost of these products in general. This also applies to the process of bringing suitable buying and selling parties together – enabled by lower search and contact costs, using internet technology (SINGH, 2004). Constant advantages of digital information or goods are non-declining values, easy reproducibility and modifiability. Digital technology has the potential to reduce transaction costs beyond the bundling effects of a retailer, by transforming cost incurring operations into digital forms. As a result, search or contracting costs can be reduced for all participants of a transaction[3].

The trade sector is confronted with the challenges of the last and present decade. Increasing consumer demands are accompanied by fast and intensive information-seeking behavior via the Internet (BMEL, 2017a). Additionally, consumers expect modern farms to produce safe, healthy products under transparent conditions and in harmony with animals, the environment, resources and mankind (e.g. ZANDER et al., 2013; KANTAR EMNID, 2017). Consequently, an upward trend of organically produced products can be noticed on the producer side indicated by an increase of the area used for organic production by 9.7% in 2017 as well as an increased share of organic sales in the retail industry from 3.5% in 2008 to 5.1% in 2016 (BÖLW, 2009; BMEL, 2018; BÖLW, 2018). Recent federal statistics also show that people are particularly interested in products of regional origin (78%) and transparency attributes. The statistics reveal that consumers care about animal husbandry (79%), fair (84%), environmentally friendly (82%) and GMO-free (81%) production conditions, and that consumers are willing to pay for these attributes. Furthermore, recent survey data show that consumers consider the supply of regional products to be an essential, strategic direction of stationary retailers, to prevent customers from turning to online grocery stores (TRND and TERRITORY, 2017). The threat that the online competition could meet the needs of this very niche is thus clearly perceived by the consumer. Both of these factors, driving the modern food retail markets can be perceived as opportunities, as well as challenges.

Digital networks with simplified methods for cost-effective contact establishment, as well as current trends in consumer demands and values regarding their claims to 21st century foodstuffs, present opportunities for a potentially effective use of digital channels to market certain food products. Since websites and online marketplaces are nowadays easy and cheap to design and implement, the internet could enable (transactional) cost-effective sales from regional manufacturers with modern values, directly to end users via digital platforms which provide high potential to generate utility for modern consumers. As indicated previously, one objective of the study is to examine consumers' willingness to use modern IT to purchase certain food items.

An issue with online shopping and food items in general is consumers' confidence in quality characteristics. Foods are complex bundles of quality characteristics, many of which cannot be directly assessed by the consumer. Information asymmetries tend to influence the behavior of buyers and sellers in a negative

[2] According to the HDE (German trade association) (2015) transaction costs often can account for more than 50% of the total costs.

[3] One anonymous reviewer pointed out that it should be emphasized that there are product fields or attributes (e.g. haptics, smell) where the transferability into digital forms is (nowadays) not possible or at least extremely difficult and the attempt could even result in increasing costs.

way (see also AKERLOF, 1970). Overcoming information asymmetries can therefore positively influence transactions carried out between market participants (ZÜHLSDORF et al., 2012). KANG and HUSTVEDT (2013) conclude that consumers are willing to support social responsibility and that trust has a significant and positive impact on loyalty and the purchase intent. Conscientiousness and social responsibility also have direct influence on trust itself. They describe transparency as a tool that directly influences perceived economic, social and environmental responsibility, which again results in a positive influence on the attitude towards the company and the purchase intent of consumers. In the absence of confidence regarding the truth of the provider's statements, the risk that the consumer chooses the non-purchase-option remains. By using signaling instruments, a (regional) producer of directly marketed products could contribute to increased consumer trust, for example, by presenting individual production and animal husbandry conditions, or by giving consumers the opportunity to visit the farm, or to contact the producer personally. This might constitute an advantage over large industrial companies located nationwide or even internationally within the manufacturing and supply chain of a large grocery retailer. For this reason, attributes of transparency are included in the following analysis of valuing hypothetical products.

3 Conceptual Framework

Based on the consumer theory developed by LANCASTER (1966), choice experiments are employed to determine consumer preferences for product attributes, since utility is derived from combinations of product characteristics, rather than a product per se. MCFADDEN'S (1974) random utility model provides the statistical framework to model consumer choice. In our study, an individual *n* receives utility *U* from choosing an alternative *j* equal to $U_{nj} = U(X_{nj})$, where X_{nj} is a vector of the attributes of the food product alternative *j* from a finite set of *k* alternatives in a choice set *C*. Since utility is modeled as a deterministic component, depending on the attributes of an alternative and a stochastic component, it applies $U_{nj} = V(X_{nj}, \beta_n) + \varepsilon_{nj}$, where *V* is a function of the attributes X_{nj} and the coefficient vector β_n, represents the deterministic part, and ε_{nj} is the stochastic component of the utility function. The probability that a participant *n* chooses alternative *j* is equal to the probability that the utility *U* this participant derives from the alternative is greater than or equal to the utility derived from another alternative *k* of the specific choice set *C*. The probability of choosing alternative *j* can be expressed as:

$$P(j) = Prob\{V_{nj} + \varepsilon_{nj} \geq V_{nk} + \varepsilon_{nk}; \quad j \neq k, \forall k, \in C\} \tag{1}$$

To account for preference heterogeneity, we use a ML model, and then a LC model to examine the sources of heterogeneity. The LC model involves a segmentation of individuals into different classes, based on socioeconomic and attitudinal data. Within these directly unobservable latent classes, homogeneity in preferences is assumed (BOXALL and ADAMOWICZ, 2002).

Relaxing the limitations of conditional logit models, ML models are designed to allow random preference variation, meaning the coefficient vectors are subject to the individual's preferences. The deterministic component in the ML model is defined as $V_{nj} = X_{nj} \bullet \beta_n$, where β is a vector of random parameters representing the varying individual taste. Following TRAIN (2009) and DING and ABDULAI (2018), these assumptions lead to the probability that individual *n* chooses alternative *j* from choice set *C* in situation *t* is the integral of conditional probability

$$P(njt) = \int \frac{e^{\beta_n * x_{njt}}}{\sum_k e^{\beta_n * x_{nkt}}} f(\beta) d\beta \tag{2}$$

describing the ML as a mixture of the logit function evaluated at different β's with $f(\beta)$ as the mixing distribution.

Although preference heterogeneity is accounted for by using the ML model, the source of this heterogeneity remains unobserved (OUMA et al., 2007). Assuming socioeconomic and attitudinal factors to be the drivers of heterogeneous preferences, and derived from the conditional logit model, we assume that an individual *n* belongs to a specific section of the population *s*; the probability that an individual *n* chooses alternative *j*, given that he or she belongs to a latent class *s* can be specified as

$$P(nj \mid s) = \frac{\exp(\beta_s X_j)}{\sum_{k \in C} \exp(\beta_s X_k)} \tag{3}$$

Since latent classes are not directly observable, they are expressed by a latent membership likelihood function that classifies individuals into specific groups (BOXALL and ADAMOWICZ, 2002). Thus, the class probabilities can be described as a multinomial logit form

$$P(s) = \frac{\exp(\lambda_s Z_n)}{\sum_{s=1}^{S} exp\,(\lambda_s Z_n)} \tag{4}$$

where Z_n is a vector of psychometric and socioeconomic characteristics and λ_n a parameter vector. In this model the *s*th parameter vector is normalized to zero.

To determine the optimal number of latent classes, the minimum (consistent) Akaike Information Criterion (CAIC) as well as the Bayesian Information Criterion (BIC) are used.

As indicated previously, we use the endogenous attribute attendance (EAA) model proposed by HOLE (2011) to account for attribute non-attendance (ANA). In this study, we model an inferred ANA approach since stated ANA may also be subject to endogeneity bias (e.g. HOLE et al., 2013; BELLO and ABDULAI, 2016). The EAA framework can be perceived as a variant of a LC model. It can control for all possible attribute subsets, and thus all possible combinations of ANA. In the two-step analysis of the EAA model, it is assumed that the respondent first decides on which attributes to take into account, and secondly chooses an alternative, conditional on the remaining attributes according to his or her preferences. Following HOLE (2011), the probability that an individual *n* chooses alternative *j* on choice occasion *t*, conditional on the choice of attribute subset C_q is represented by:

$$P\,(njt \mid C_q) = \frac{\exp(\sum_{k \in C_q} x_{njt}^k \beta^k)}{\sum_{j=1}^{J} \exp(\sum_{k \in C_q} x_{njt}^k \beta^k)} \quad (5)$$

where x_{njt}^k represents individual *n* choosing the value of attribute *k* relating to alternative *j* from attribute subset C_q on choice situation *t* and β_s is the preference weight for attribute *k*. It is further specified that the probability that the respondent *n* takes attribute *k* into account is $\exp(\gamma_k z_n) / [1+\exp(\gamma_k z_n)]$, where z_n is a vector of individual characteristics and γ_k is a vector of parameters to be estimated. Assuming these probabilities are independent over attributes, the probability of choosing subset C_q is given by:

$$P\,(nC_q) = \prod_{k \in C_q} \frac{\exp(\gamma_k z_n)}{1+\exp(\gamma_k z_n)} \prod_{k \notin C_q} \frac{1}{1+\exp(\gamma_k z_n)} \quad (6)$$

As in HOLE et al. (2013), the unconditional probability that an individual *n* chooses alternative *j* from a choice set C in a given situation *t*, through choosing an attribute subset C_q is

$$P^{EAA}(njt) = \sum_{q=1}^{Q} P_{nC_q} \prod_{t=1}^{T} \prod_{j=1}^{J} (P_{njt \mid C_q})^{Y_{njt}} \quad (7)$$

where, *Y* takes the value 1 when alternative *j* is chosen, and 0 otherwise.

Model- and class-specific WTP values for the different steak product attributes *X* are calculated as the rate of change in the attribute coefficient β divided by the rate of change of the price parameter y_{ps} (marginal rate of substitution). This is given as

$$WTP = -\left(\frac{\partial U/\partial X}{\partial U/\partial P}\right) = -\frac{\beta_{as}}{y_{ps}} \quad (8)$$

4 Survey Design and Data

An online questionnaire was used to collect information from respondents between December 2017 and January 2018. The distribution of the questionnaire took place directly over the internet, mostly through social media such as facebook-groups, e-mail distribution lists and others. The reason for this approach is because of the early development status of the examined market, as indicated in the introduction. Because of these underlying expectations, the focus was directly placed on actual internet users. To avoid the distribution within a certain "filter bubble", several different accounts, groups etc. were used in the distribution process.

In the present study, we selected meat as the online food product to examine. In order to make the choice simple, the product used in the CE was "fresh steak" of 200 grams. Each alternative steak option was described by seven attributes, which are presented in Table 1 alongside the respective levels. Price (4 levels), was simplified and based on real market prices to capture the WTP. Husbandry conditions (conventional/ organic), origin (regional/ Germany) and slaughterhouse type (industrial scale/ small on-farm slaughtering) represent characteristics that can contribute to the sustainability or perceived sustainability of a product as a whole. Shipping (3 levels) was introduced to represent additional costs for ordering online. As transparency items, a contact or farm visiting option (yes/no), as well as pictures of the farm or the husbandry conditions as a hypothetical self-presentation of the producer (picture/"The producer does not present pictures of the farm/the conditions under which livestock is kept") were introduced. The selection of the attributes was mainly based on consumer valuations of food and value chain characteristics, derived from studies of the Federal Ministry of Food and Agriculture (BMEL) (BMEL, 2017a, 2017b).

Since a LC approach was employed to identify the source of heterogeneity among consumers, the questionnaire also covered socio-economic aspects, shopping and online shopping behavior, as well as attitudes towards food. The attitude was thereby queried via attitudinal statements measured on Likert

Table 1. Attributes and attribute levels

Variable	Code	Levels
Price	1	4 €
	2	6 €
	3	7 €
	4	8 €
Origin	0	Germany
	1	Regional (<30 km)
Slaughter-house type	0	Industrial scale slaughterhouse
	1	Small on-farm Slaughterhouse / small business
Organic	0	No / conventional livestock farming
	1	Yes / organic livestock farming
Picture	0	No / The producer does not present pictures of his farm / the conditions under which livestock is kept
	1	Yes (image presentation)
Contact	0	Possibility to visit the farm and / or contact the producer personally: No
	1	Possibility to visit the farm and / or contact the producer personally: Yes
Shipping	0	0% of purchase price
	1	5% of purchase price
	2	10% of purchase price

Source: authors' own presentation of collected data

scales within the questionnaire (examples of which can be found in appendix A). The study thus focuses on people with a potential pioneering role regarding increased affinity to specific innovative products with certain sustainability characteristics, as well as shopping opportunities, which was accounted for by the selection of the distribution channel of the questionnaire (e.g. FISCHER, 2014). Each respondent was presented with eight choice sets to choose from. Each set contained three alternatives, respectively. Two of the three alternatives represented online purchases, with alternative three representing the conventional supermarket purchase. While all levels of the attributes of the online alternatives rotated, most attributes of the supermarket alternative had consistent levels. In order to simulate a perceived distance from the consumer to the producer when buying at a supermarket, the highest quality product (e.g. best possible transparency) could never be purchased by choosing the supermarket option. An example of a choice card can be found in appendix B. As in previous studies, an experimental design was used to achieve a practicable and experimentally feasible concept and to reduce the probability of respondent fatigue (BECHTOLD and ABDULAI, 2014). With specific designs, the number of performed experimental procedures is kept as low as possible, while ensuring the most informative factor combinations (e.g. HENSHER et al., 2005; ERIKSSON et al., 2008). We chose a D-optimal approach which reduces the number of design runs, while guaranteeing a balanced design. Thus, starting from a full design and based on a maximized information matrix with a resulting determinant, it generates an experimental approach that contains the best possible experimental subset (ERIKSSON et al., 2008). This procedure resulted in 32 generic choice sets, divided into four blocks. All analyzes and estimations were done using Stata® 13.

Since the effectiveness of hypothetical bias mitigation tools is well documented in the literature (e.g. CUMMINGS and TAYLOR, 1999; LUSK, 2003; BELLO and ABDULAI, 2016), and cheap talk (CT) scripts are particularly proven to be effective under online survey conditions (TONSOR and SHUPP, 2011; HOWARD et al., 2017), a CT script (see appendix C) was implemented to mitigate the impact of hypothetical bias and to ensure more reliable estimates. After an introduction into the topic, an explanation of certain terms, attributes and conditions, followed by the CT script, the choice sets were presented and respondents had to state their hypothetical purchase decisions.

The total number of evaluable questionnaires was 201 with about 60% female and 40% male respondents. With an average age of 31, the sample appears to differ from the German population, with an average age of 44 (DESTATIS, 2017). However, a higher online shopping affinity within the younger population is presumed, and females often tend to be the main food shoppers. Thus, this distribution corresponds to a group of people (as described by FISCHER, 2014) with an above-average interest in products with sustainability characteristics. The sample represents a relatively younger, well-educated (about 50% with university or university of applied sciences degree) group of people with an average categorical disposable income of 1,300€ to 2,600€. The data show that about 32% of the respondents live in rural areas and smaller cities, while 68% live in large cities or metropolitan areas. The main household types are singles (49%), followed by couples without children (32%), couples with children (13%), couples with children no longer living in the household (3%), and a rest (3%). Descriptive statistics about common shopping behavior already indicate that majority of the examined group tend to purchase their fresh food predominantly in supermarkets (64.18%), hypermarkets (4.48%) or discount stores (15.92%), although the majority of the respondents (60.7%) indicate that the freshest food of the highest quality can be purchased in farm shops. The main

reasons not to buy in farm shops, despite the expected high quality, are information deficits (48%) and difficult accessibility (31%). The main reasons why people want to purchase products from farm shops are the support of local businesses (70.3%), trust in higher quality (54.1%), personal contact with producer (53.4%), and transparent animal husbandry and production conditions (25.7%).

5 Empirical Results

5.1 Estimates of the Mixed Logit Model

The estimates of the ML model are presented in Table 2. It can be observed from the Table that the model and all estimated parameters are statistically significant at the 1% level. In line with economic theory, a negative price coefficient indicates rational consumer behavior. Further, consumers prefer products of local origin, small scale on-farm slaughterhouses, organic quality and transparency, provided by pictures and contact or visiting possibilities. On average, online shopping of fresh meat and additional shipping costs lower the purchase probability. Examining the standard deviation (SD) of the attributes, significant values indicate heterogeneity for these attributes. We find this to be confirmed for all attributes except for the visual presentation of the farm or husbandry conditions. Following OUMA et al. (2007), the probability of negative coefficient is calculated by 100* Φ(-mean/standard deviation) (where Φ is the cumulative standard normal distribution) to present the shares of the sample that assess particular attributes in a positive or negative way. As expected, we find a low level of acceptance for higher price and shipping parameters within the sample. The values further indicate that about 77% of the consumers prefer local origin, 88% and 87% prefer small scale on-farm slaughterhouses and organic quality, respectively. The transparency attributes picture and contact possibility are preferred by 100% and 83%, respectively. Although we find a negative coefficient for the online option, the high and significant SD value indicates a heterogeneous opinion, with about 34% preferring the online option. In Table 3, consumers' WTP estimates for the analyzed attributes of fresh steaks with different purchase options are presented. The estimates are all highly significant and indicate that consumers are willing to pay a premium for quality enhancing attributes. The highest monetary valuation is thereby associated with organic quality (3.07€), followed by small scale on-farm slaughterhouse (2.23€) and contact possibility (1.63€).

Table 3. WTP for attributes in € from Mixed Logit Model

Variable	
Local origin	0.77***
Small scale on-farm slaughterhouse	2.23***
Organic quality	3.07***
Picture	1.28***
Contact possibility	1.63***
Shipping	-0.56***
Online option	-2.69***

*, ** and *** indicate statistical significance at 10%, 5% and 1% level, respectively.
Source: authors' own calculations

Table 2. Mixed Logit Model: Maximum Likelihood Estimates

Variable	Mean		SD		Prob of Coef. (negative)
	Coef.	Std. Err.	Coef.	Std. Err.	
Price	-0.536***	0.060	0.546***	0.067	0.837
Local origin	0.412***	0.122	0.556**	0.232	0.229
Small scale on-farm slh.	1.193***	0.190	1.011***	0.231	0.119
Organic quality	1.644***	0.173	1.473***	0.197	0.132
Picture	0.687***	0.126	0.205	0.304	0.000
Contact possibility	0.872***	0.179	0.927***	0.192	0.173
Shipping	-0.299***	0.084	0.439***	0.136	0.752
Online option	-1.443***	0.310	3.435***	0.342	0.663
Number of obs	4824				
Log Likelihood	-1161.4845				
LR chi2(8)	756.15				
Prob > chi2	0.0000				

*, ** and *** indicate statistical significance at 10%, 5% and 1% level, respectively. Slh.: slaughterhouse
Source: authors' own calculations

Shipping costs and the online option are negatively valued, indicating that, on average, consumers are not willing to accept extra costs and the purchasing process via the internet, although the values also indicate that a product that meets for example organic and small scale on-farm slaughterhouse quality properties might be able to overcome the gap between the non-acceptance and acceptance of an online purchase.

Table 4. Criteria for number of classes

Number of classes	LLF	Nparam	CAIC	BIC
2	-1234.308	30	2657.715	2627.715
3	-1140.954	52	2609.68	2557.68
4	-1084.71	74	2635.865	2561.865
5	-1045.305	96	2695.728	2599.728

Source: authors' own calculations

In line with OUMA et al. (2007), we also present figures from a kernel density approach with Gaussian kernels and variable-bandwidth, to increase the information level by examining the distribution of the WTP within the sample. The presented values in figures 1C, 1E, 1F, 1G indicate heterogeneity in consumer preferences, since we can identify more than one peak within the course of the function. The forms of the functions of the sections 1C, 1E, 1F indicate an overall consensus of the majority of consumers, with the peaks probably indicating the presence of smaller subgroups of consumers within the sample, who are willing to pay a higher premium for organic quality as well as contact possibilities, and are more likely to accept an extra fee for shipping, compared to the average consumer. For the online option, we identify three peaks with the mean in the negative range in figure 1G, implying a subgroup of consumers with a high aversion to this option, as well as a group with a positive willingness to pay for the online grocery shopping. In figures 1B and 1D, we identify right-skewed distributions, with a decreasing slope, indicating overall positive and more homogeneous preferences, but with tendencies to include a group of consumers who are willing to pay a slightly higher premium for these attributes. Since we identify a relatively even distribution in 1A, it further seems that positive and homogeneous preferences prevail for products of local origin.

5.2 Estimates of the Latent Class Model

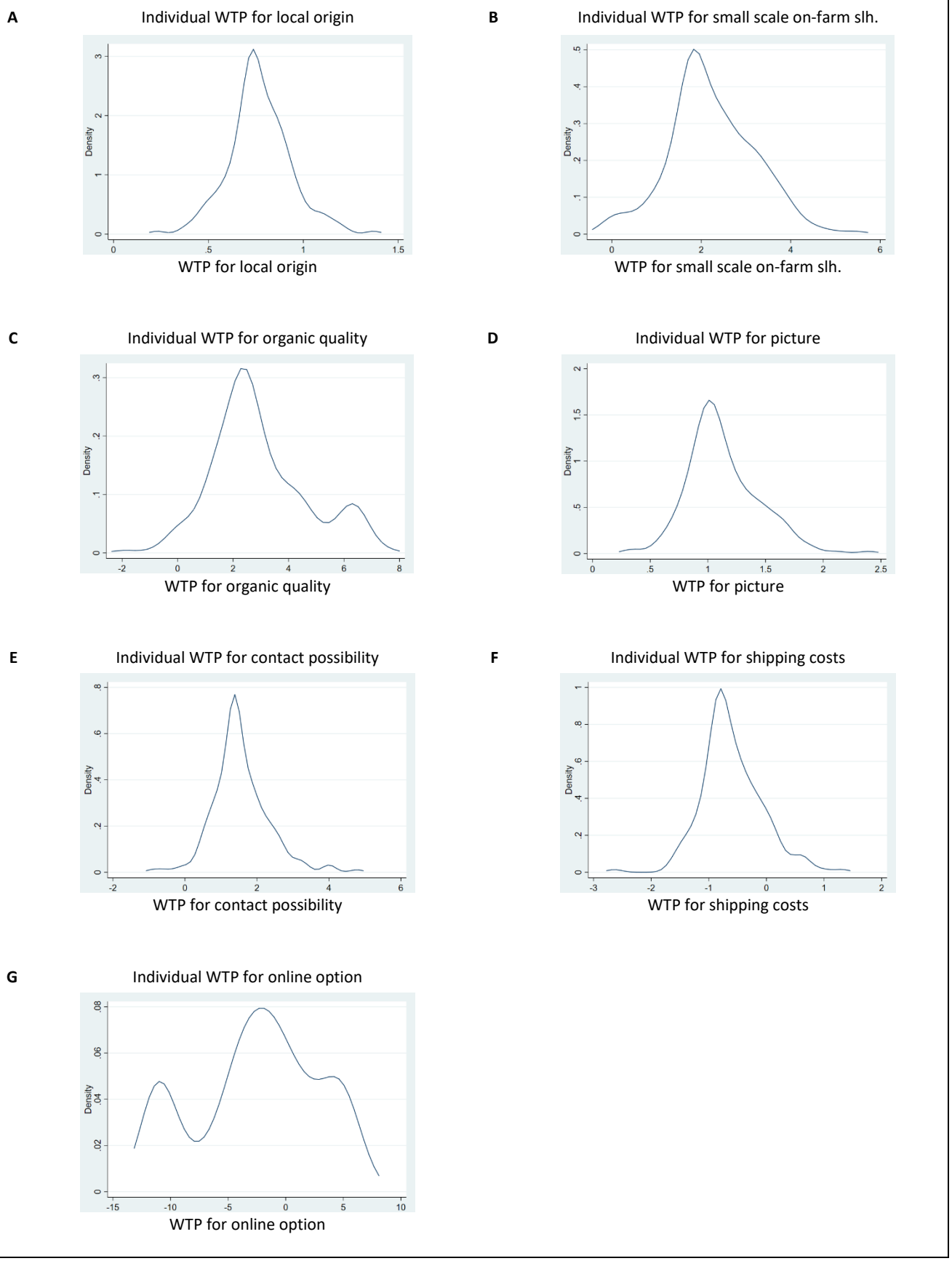
The following section presents the empirical results of the LC analysis. We first use the Consistent Akaike Information Criterion (CAIC) and Bayesian Information Criterion (BIC) to determine the optimum number of latent classes (e.g. BOZDOGAN, 1987; BOXALL and ADAMOWICZ, 2002). The results are presented in Table 4.

The estimates show that the model fit improves, as more classes are added. Indicated by the CAIC and BIC, this relationship changes when a number of three classes is reached, suggesting that the values are associated with three classes in our latent class model.

Table 5 presents the maximum likelihood estimates of the utility functions of the three heterogeneous classes, as well as the class membership parameters. We first discuss the results of the membership variables to give an overview of the general character of the classes, followed by a presentation of the characterized classes according to their choice model parameters, i.e. their attribute preference structures. The membership parameters of class three are normalized to zero, which means that the parameters of class one and two are to be interpreted relative to this class. The Table shows to what extent the determined groups differ significantly from the reference group three. In order to assess a tendency, the variable *Household Income* of class one with a P > | z | value of 0.105 has additionally been included in the interpretation. It should be noted that any interpretation based on this value should be considered less indicative. The class shares indicate that 25.3%, 43.3%, and 31.4% of the respondents have the probability of belonging to the classes one, two and three, respectively. The statistically significant variables indicate that members of class one, compared to class three, have no increased quality expectation when buying food in farm shops or weekly markets. They tend to trust supermarket qualities. Similarly, this group pays less attention to organic labels or organic quality (a high value on the scale indicates an increased rejection of the statement) and they exhibit lower education and income levels. The positive sign of the age group membership indicates that the age level is higher, relatively to group three. The negative coefficient of the *Particular attention to regionality* variable indicates that members of class two are paying more attention to regionality when choosing food items, while organic quality appears to be less important.

For all groups, the negative and significant price coefficients show consistent and rational behavior, with consumers less likely to buy a product, as the price

Figure 1. Estimated kernel densities of individual WTP estimates



Slh.: slaughterhouse
Source: authors' own calculations

Table 5. Latent class model with 3 latent classes: Maximum Likelihood Estimates Choice model parameters and average class shares

Variable	Class1	Class2	Class3
Price	-0.448***	-0.136***	-0.856***
	(0.133)	(0.043)	(0.085)
Local origin	1.133*	0.354***	0.005
	(0.610)	(0.099)	(0.194)
Small scale on-farm Slh.	0.603	0.689***	1.083***
	(0.655)	(0.125)	(0.280)
Organic quality	0.175	0.842***	2.215***
	(0.377)	(0.111)	(0.328)
Picture	1.053**	0.373***	0.432**
	(0.524)	(0.105)	(0.213)
Contact possibility	-0.819	0.595***	0.907***
	(0.736)	(0.130)	(0.283)
Shipping	-0.751**	-0.028	-0.510***
	(0.321)	(0.067)	(0.121)
Online option	-3.894***	0.569**	-0.651*
	(0.787)	(0.223)	(0.389)
Class share	0.253	0.433	0.314
Class membership model parameters: Class3 = Reference class			
Variable	**Class1**	**Class2**	**Class3**
Constant	3.093	0.745	0.000
	(2.497)	(2.413)	
Online shopping freq.	-0.078	0.089	0.000
	(0.246)	(0.243)	
Expectation: higher quality in farm shops / weekly markets	-2.348**	0.410	0.000
	(0.979)	(1.241)	
Willingness to buy groceries online	-0.750	0.313	0.000
	(0.514)	(0.478)	
Particular attention to regionality	-0.327	-0.567*	0.000
	(0.325)	(0.300)	
Particular attention to price	0.262	0.384	0.000
	(0.306)	(0.294)	
Particular attention to traceability	0.241	-0.477	0.000
	(0.341)	(0.337)	
Particular attention to organic quality	0.491*	0.769***	0.000
	(0.263)	(0.255)	
Quality is more important than price	-0.103	-0.257	0.000
	(0.336)	(0.370)	
Particular attention to sustainable production methods	0.305	-0.369	0.000
	(0.318)	(0.303)	
Education	-0.935**	-0.116	0.000
	(0.375)	(0.364)	
Household income	-0.470[a]	-0.199	0.000
	(0.290)	(0.248)	
Gender	-0.351	0.159	0.000
	(0.533)	(0.483)	
Age	0.467*	0.211	0.000
	(0.276)	(0.250)	

*, ** and *** indicate statistical significance at 10%, 5% and 1% level, respectively. standard errors in parentheses; Slh.: slaughterhouse
[a]: $P > |z| = 0.105$
Source: authors' own calculations

increases. It should be noted that class three clearly represents a highly price sensitive group, followed by class one and class two. Judging by the significance levels, members of class one gain utility from attributes that are associated with the online product option (local origin and transparency, which is represented by the presentation of a picture). However, high negative coefficients of the variables *Shipping* and *Online Option* indicate a general rejection of the internet purchase of fresh meat, suggesting that a higher utility gained from local production and transparency is not able to overcome the general utility loss caused by online shopping (*Online Shopping Skeptics*). These findings are consistent with the skeptical attitude – compared to class three – towards organic and farm shop quality of a relatively older and less educated section of the population, having lower incomes. Members of this group seem to have general trust issues regarding credence or experience goods such as food items.

Exclusively significant, positive online shopping related estimates for class two imply that this group most likely represents online shopping advocates, since they gain higher utility from attributes associated with online options. The class membership estimates reveal that members of this group may particularly trust local producers to provide the quality they are willing to pay for. The *Organic Quality* attribute is linked to a significantly positive coefficient, indicating that class members are willing to pay for credence characteristics of food items. Due to their positive attitude towards the online shopping option, this group is characterized as *Innovative Online Advocates*.

Examining the experimental behavior of potential members of class three, that is, the group specific results of the LC model, it turns out that this class is associated with lower estimates for each coefficient of the quality and transparency attributes than the comparison groups. Although class 3 clearly shows positive coefficients, especially for organic quality, small scale on-farm slaughterhouses and contact possibilities, it represents a class with the highest price sensitivity. We interpret members of this group as individuals with values that may be associated with direct, positive willingness to make higher payments, but the absolute higher price sensitivity might be able to outweigh these values. They are characterized as *Neutral Consumers*.

As in previous studies (e.g. GREENE and HENSHER, 2003; OUMA et al., 2007; SHEN, 2009), we find that both mixed logit and LC models outperform the standard MNL model. We present the AIC, BIC and the $\rho;^{-2}$ to compare non-nested models. Even though the models differ in their specific assumptions, statistical comparisons allow an estimation of the model fit. Table A1 in appendix D indicates a slightly better model fit of the ML model for the present data, indicating a more realistic order of preference at the individual level. However, as the product we analyze is a commercial consumer product, we consider marketing at the individual level to be unrealistic. With classes taken into account, determined by socioeconomic and attitudinal characteristics, marketing for specific groups within the population comes closest to the real scope for action of sellers.

5.3 Empirical Results of the Endogenous Attribute Attendance (EAA) Model

Table 6 presents the results of the EAA model. Following DING and ABDULAI (2018), we estimate several models to focus on the variables with lower non-attendance probabilities step by step. In this case, we apply 4 models. Since the respondents choose normal consumer goods, we assume price attendance for all models. The coefficients of model 1 show similar signs (with larger values than the coefficients of the ML model) indicating a difference in modeled preferences, when ANA is taken into consideration. We estimate several models to focus on attributes with lower non-attendance probability.

The first model reveals that the positively assessed attributes, contact possibility and local origin are the most frequently ignored attributes, with 79% ANA and 78.5% ANA, respectively. The organic quality as well as the presentation of the picture represent the least ignored attributes in this model. The estimates in models 2 to 4 reveal the EAA with jointly estimated ANA probabilities of the most frequently ignored attributes. This systematic exclusion of attributes reveal that, for example, in model 2, the most frequently ignored attribute is described by the online option with 78.1%. These findings indicate that consumers are willing to pay premiums for the premium quality meat of local origin from producers with contact possibilities. However, these attributes are the least important items to the members of the analyzed sample. The same applies for the aversion towards the online purchase option. Even though we can identify this aversion – including a subgroup of consumers having a strong aversion – the high non-attendance might indicate the possibility to overcome this problem. This suggests that there is a market opportunity

Table 6. Endogenous Attribute Attendance Model

Variable	Model 1		Model 2		Model 3		Model 4	
	Coef.	ANA	Coef.	ANA	Coef.	ANA	Coef.	ANA
Price	-0.464***		-0.444***		-0.356***		-0.345***	
	(0.038)		(0.036)		(0.031)		(0.03)	
Local origin	1.735***	0.785***	0.911***		1.796*		1.029	
	(0.550)	(0.11)	(0.246)		(1.086)		(0.834)	
Small scale on-farm Slh.	2.146***	0.598***	2.186***	0.622***	1.928***	0.614***	1.998***	0.680***
	(0.309)	(0.080)	(0.340)	(0.084)	(0.231)	(0.070)	(0.234)	(0.680)
Organic quality	2.426***	0.451***	2.402***	0.473***	2.228***	0.486***	2.099***	0.477***
	(0.308)	(0.083)	(0.305)	(0.086)	(0.241)	(0.070)	(0.260)	(0.086)
Picture	1.128***	0.491**	0.989***	0.432*	1.159***	0.346**	1.229***	0.499***
	(0.419)	(0.242)	(0.369)	(0.244)	(0.217)	(0.144)	(0.256)	(0.139)
Contact possibility	2.375***	0.790***	1.556***		-1.203		-0.787	
	(0.690)	(0.111)	(0.322)		(1.213)		(0.816)	
Shipping	-1.110***	0.668***	-1.022***	0.651***	-1.192***	0.754***	-0.509	
	(0.213)	(0.080)	(0.191)	(0.082)	(0.206)	(0.061)	(0.316)	
Online option	-6.501***	0.781***	-6.390***	0.781***	-6.408***		-4.557***	
	(0.669)	(0.031)	(0.646)	(0.031)	(1.029)		(0.907)	
Excluded attributes				0.653***		0.783***		0.750***
				(0.096)		(0.031)		(0.040)
Number of obs	4824		4824		4824		4824	
Wald chi2(8)	252.18		267.15		277.15		255.61	
Prob > chi2	0.0000		0.0000		0.0000		0.0000	
LL	-1204.1499		-1206.9597		-1249.9963		-1266.0222	

*, ** and *** indicate statistical significance at 10%, 5% and 1% level, respectively. Standard errors are in parentheses; Slh.: slaughterhouse
Source: authors' own calculations

for fresh meat purchased online, if the highly valued requirements such as organic quality and transparency provided through pictures are met. Analyzing Model 3 and 4, this image of the appreciation of the individual attributes is intensified, with organic quality, transparency through pictures and small scale on-farm slaughterhouses being the least ignored attributes.

5.4 Willingness to Pay Estimates

Table 7 presents the significant model- and class-specific WTP estimates for all three models for the included product attributes.

The findings of the LC model underline the presumption of class one being online shopping skeptics. Since the highest experimental meat price level is 8.00€, a willingness to accept 8.68€ as a compensation for the online option seems highly unrealistic, which leads to the interpretation that online shopping of fresh groceries would never be accepted by this particular group of consumers. The values for class two further indicate that people who are likely to be in that group are really willing to pay for high quality products purchased online. They appear to be consumers who are willing to pay for modern values and products with specific sustainability characteristics such as animal welfare and transparency, combined with a new possibility of using online retail channels. Although their WTP is also high, this leads to the conclusion that the Euro values should rather be interpreted as indicative tendencies. The results for class three reveal that this group of consumers are the second best target group for a marketing strategy regarding online fresh meat. In particular, they appear to be ready to pay higher prices for perceived premium quality.

The WTP estimates of the EAA model are presented in the last column of Table 7. We find average WTP coefficients of higher absolute values than those in the ML model, suggesting that when ANA is taken into consideration, the estimates show stronger WTP attitudes for particular attributes that consumers consider important.

Table 7. Model-/ class-specific WTP for attributes (€)

Variable	ML Model	LC Model			EAA Model 1
		Class 1	Class 2	Class 3	
Local origin	0.77***	2.53*	2.60**	NS	3.74***
Small scale on-farm Slh.	2.23***	NS	5.06***	1.27***	4.63***
Organic quality	3.07***	NS	6.17***	2.59***	5.23***
Picture	1.28***	2.34[a]	2.74**	0.51**	2.43***
Contact possibility	1.63***	NS	4.38***	1.06***	5.12***
Shipping	-0.56***	-1.68**	NS	-0.60***	-2.39***
Online option	-2.69***	-8.68***	4.19**	-0.76*	-14.02***

*, ** and *** indicate statistical significance at 10%, 5% and 1% level, respectively. NS: not statistically significant; Slh.: slaughterhouse
[a]: $P > |z| = 0.106$
Source: authors' own calculations

6 Discussion and Conclusions

Although online purchase of fresh food products in Germany is currently low, the market appears to be in a promising growth phase (e.g. WARSCHUN et al., 2013, 2016; HDE, 2017; STATISTA, 2017). Given the current skepticism about the meat industry and the complex expectations modern society places on agriculture and production operations (e.g. ALBERSMEIER and SPILLER, 2010; ZANDER et al., 2013; SPILLER et al., 2015), online retailing actually offers a channel for direct marketing for food producers to signal certain values and transparency, without relying on traditional food distributors. Hence, it is important to examine consumer preferences to provide a better understanding of the specific market potential. In this study, we employed a discrete choice experiment approach to analyze consumers' preferences for willingness to purchase fresh meat, steaks of 200 grams, with quality-indicating characteristics through online retail channels. A supermarket purchase choice served as an opt-out option. We used mixed logit and latent class logit models to examine preference heterogeneity and the sources of heterogeneity, as well as endogenous attribute attendance models to account for consumer attendance tendencies.

The empirical results obtained from the analysis revealed significant heterogeneity in preferences among consumers for meat products. Specifically, consumers showed high preferences for meat with high quality or perceived high-quality characteristics such as local production, organic quality from small slaughterhouses and transparency provided by contact possibilities and pictures. The results are in line with previous studies that find increased willingness to pay (WTP) or strong consumer preferences for specific quality characteristics of meat products (e.g. VAN LOO et al., 2014: SPILLER et al., 2015). The findings from the latent class model show that socioeconomic and attitudinal factors tend to drive consumers' preferences for online food products as well as certain quality-indicating attributes in our experiment. In particular, younger and internet-savvy consumers (Innovative Online Advocates) were found to exhibit higher WPT for online shopping attributes, as well as online shopping itself, whilst the less educated elderly exhibited some skepticism about shopping food products online. These Online Shopping Skeptics tend to trust supermarket qualities and gain additional utility from local production and transparency.

The results also showed that choices were affected by the attribute processing strategies of consumers. In particular, we found that, when attribute non-attendance (ANA) is taken into account, the WTP for some attributes were much higher, suggesting that ANA needs to be taken into consideration when analyzing consumers' preferences in choice experimental setups. More importantly, the model reveals that organic quality and transparency provided through pictures are the least ignored attributes, and the online shopping option is within the top three of ignored attributes. This indicates that if the highly valued requirements such as organic quality and transparency provided through pictures are met, consumers might be willing to purchase online as they tend to ignore the purchase channel in favor of the desired product. This relation emphasizes the potential market opportunity for fresh meat purchased online.

Overall, the findings of the study indicate some quite useful information for suppliers of online food products, in this case for suppliers of fresh meat, who could use consumer segmentation as a marketing strat-

egy. Given that some consumer groups are willing to pay and purchase online food products with specific attributes, suppliers could make use of this information in their online food product sales. The heterogeneous preferences of consumers call for target-oriented communications regarding online food attributes that add value to the product, and could reduce the price sensitivity or online shopping aversion of some consumer groups. The highest monetary valuation was found to be associated with organic quality, small scale on-farm slaughterhouse and contact possibility, while organic quality, transparency through pictures and small scale on-farm slaughterhouse are the attributes that are less likely to be ignored within the choice process. This leaves the latter two as the most important attributes to determine a high-quality product and to absorb the highest WTP. Similarly direct online marketing can overcome the massive information and accessibility problems. The increase in popularity of online shops for meat products through segment or group specific advertisement and the targeted elaboration of the benefits of such concepts is thus the focus of a recommendation for action for producers and system operators. However, the authors believe that these results are not freely transferable to other fresh products in the online retail sector. To the extent that different products provide different intrinsic and extrinsic values for different consumer groups, product groups need to be evaluated differently. For example, meat products may have different values than fruits, and the values of domestic products can differ from those of products from developing countries (e.g. animal welfare, pesticides, wages, working conditions, deforestation, loss of biodiversity, etc.). Therefore, the assessment of individual products is particularly important in order to initiate targeted measures.

Although we identify a class of Innovative Online Advocates, our results are limited by the composition of the analyzed sample. Since our survey was distributed among randomly drawn internet users, it does not reflect a representative sample of the German population. As pointed out in section 4, the demographic composition of our sample already represents a group of potential early adopters (Fischer, 2014). Thus, the results must be interpreted in relation to the underlying sample structure. A class share of 43.3% of Innovative Online Advocates is therefore not freely or unconditionally transferable to the entire German population. The results thus indicate that the willingness to buy fresh meat products via online shops might still be limited to a small share of the population. However, if addressed or advertised correctly, producers can benefit from the *Online Advocates'* high willingness to pay values for very specific products.

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Appendix A – Attitudinal Statements, Likert-Scale

In appendix A an analogous translation of attitudinal statements is presented. The statements had to be evaluated by the participants on a five-level Likert scale (strongly agree to strongly disagree) to capture the general attitude towards (the purchase of) food items.

"When buying groceries...

… the quality of the product is more important to me than the price.

… the traceability of the origin of products is particularly important to me.

… I pay particular attention to organic quality / organic labels.

… the value of a healthy diet is more important to me that a quick and easy preparation.

… I pay particular attention to the price.

… I particularly trust brand products.

… I pay particular attention to sustainable and environmentally friendly production concepts.

… I pay particular attention to regionality."

Appendix B – Choice Set Example (*Translation*[1])

Steak 1 – Online purchase	**Steak 2 – Online purchase**	**Steak 3 – Supermarket purchase**
8.00 €	7.00 €	4.00 €
German producer	Local producer	German producer
Industrial scale slaughterhouse	Small on-farm slaughterhouse	Industrial scale slaughterhouse
Conventional livestock farming	Organic livestock farming	Conventional livestock farming
The producer does not present pictures of the farm/the conditions under which livestock is kept	– PICTURE HERE – (Since we are not authorized to pass the pictures on to third parties for publication, no picture is presented at this point)[2]	The retailer does not present images of the farm/livestock system.
Possibility to visit the farm and/or contact the producer personally	**No** Possibility to visit the farm and/or contact the producer personally	**No** Possibility to visit the farm and/or contact the producer personally
Shipping: 5% of purchase price	Shipping: 10% of purchase price	collection by the customer / 0%
I choose:		
Steak Option 1 ☐	**Steak Option 2 ☐**	**Steak Option 3 ☐**

[1] The authors point out that the appearance of the Choice cards can differ from the original due to different linguistic properties of different languages at lexical, syntactic and graphemic levels.

[2] In order to avoid measuring the effect of a particular representation (that is, a particular image), various images have been shown here. The authors point out that these pictures did not show any strictly negative characteristics of livestock farming. Likewise, no cruelty or deliberately negative depictions were shown. Although the concepts of *positive* and *negative* include individual values and assessment, it can be noted that the images were more of a positive depiction of animal husbandry.

Appendix C – Cheap Talk Script

After a general introduction to the experiment, we presented a *cheap talk script* directly before the first decision-making situation. In the following, we first provide an analogous translation and then the original German version.

"Previous experiments of this kind have shown that people often choose products that they would not choose in a real shopping situation. One reason for this behavior is that while they would like to buy the product, in reality they are not willing to pay the quoted price. Therefore, please think about which characteristics you personally value and to what extent your available budget for food affects your decision."

„Vorangegangene Experimente dieser Art haben gezeigt, dass Menschen oftmals Produkte auswählen, für die sie sich in der Realität jedoch nicht entscheiden würden, da sie das Produkt zwar gerne kaufen möchten, in der Wirklichkeit jedoch gar nicht bereit sind, den angegebenen Preis zu zahlen. Überlegen Sie sich deshalb bitte, auf welche Eigenschaften Sie persönlich Wert legen und inwieweit Ihr zur Verfügung stehendes Budget für Lebensmittel Ihre Entscheidung beeinflusst."

Appendix D – Information on Model Fit

Table A1. Information on model fit

	ML	LC	EAA 1
AIC	2354.969	2385.908	2438.3
BIC	2458.67	2557.68	2535.52
$\rho;^{-2}$	0.33	0.32	0.31

$\rho;^{-2}$ = Adjusted Likelihood Information Index (BEN-AKIVA and SWAIT, 1986)
Source: authors' own calculations