Consumer interest in environmental impact, safety, health and animal welfare aspects of modern pig production: Results of a cross-national choice experiment

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ABSTRACT

Are consumers interested in aspects of pig production and do they take these into account in their buying decisions when such information is available? Samples of consumers in Germany and Poland selected the two – for them – most important out of a list of ten production characteristics, relating to animal welfare, health and safety, and environmental issues. In a subsequent choice experiment, the relative weight these characteristics had in consumers' choices was estimated. Relative importance of production characteristics varied between consumer segments, with the *production interested* segment being bigger in Germany than in Poland. With the exception of one animal welfare related criterion in Germany, those production characteristics that consumers perceive as most important relate to health and safety aspects rather than to animal welfare and environmental impact.

1. Introduction

In many countries, an increasing public interest in sustainable, high quality and safe food can be observed. With respect to farm animal production, many consumers expect food production processes taking into account aspects like animal welfare and other social and ethical attributes (Boogaard, Oosting, & Bock, 2006; Tonsor, Olynk, & Wolf, 2009; Van Loo, Caputo, Nayga, & Verbeke, 2014). Furthermore, concern about health and environmental risks caused by meat production is growing due to food scandals and crises in the last decades (Krystallis, De Barcellos, Kügler, Verbeke, & Grunert, 2009). This has led to an increasing interest in the role that credence attributes (i.e., attributes that cannot be assessed by consumers, not before and not after the purchase, but need to be communicated, see Fernqvist & Ekelund, 2014) play in consumer choice, in addition to the classical search and experience attributes like appearance and taste. One should expect that such concerns would lead consumers to take aspects of the pig production process into account when choosing pork products, and to be willing to pay higher prices for pork that has been produced with concern for ethical attributes such as animal welfare, health-related attributes or attributes related to environmentally friendly production systems (Liljenstolpe, 2008). Therefore, stakeholders across the supply chain are interested in how production parameters can be used to

position their products. At the moment, production parameters are mainly used to distinction conventional from organic products, thus creating a main market for standard production and a niche market for production that bundles production parameters in a specific way. However, based on better insight into consumer preferences for production attributes, it may be possible to attain a place in the market somewhere between conventional and organic production, for example by focusing on production parameters specifically related to animal welfare, or health and safety properties. In this way, farmers obtain the possibility to differentiate their production systems to increase competitiveness (Napolitano, Girolami, & Braghieri, 2010).

Previous studies have shown that the highly industrialized and efficient pork production systems have been viewed critically by some consumer segments (Font-i-Fournols & Guerrero, 2014; Liljenstolpe, 2008). Stocking density (Vanhonacker, Verbeke, Van Poucke, Buijs, & Tuyttens, 2009), permanent fixation (Ryan, Fraser, & Weary, 2015), use of antibiotics (Lusk, Norwood, & Pruitt, 2006; Tonsor et al., 2009), the absence of straw (Benard & de Cock Buning, 2013; Boogaard, Boekhorst, Oosting, & Sørensen, 2011), use of GMO-feeds (Ngapo et al., 2004), and piglet castration (Frederiksen, Johnsen, & Skuterud, 2010) are the most criticized issues in modern pig production systems. Still, it has been shown that animal welfare is often not the most important meat choice attribute (Nocella, Hubbard, & Scarpa, 2010), as compared

to traditional pork attributes such as fat content (Mørkbak, Christensen, & Gyrd-Hansen, 2010) and country of origin (Pouta, Heikkilä, Forsman-Hugg, Isoniemi, & Mäkelä, 2010). With this proliferation of product and process attributes that can be used in the marketing of pork, consumers are increasingly confronted with multiple attributes based on which they can make choices based on their personal preferences. In making such choices, consumers can rely on those attributes that are most important to them or make trade-offs between a range of attributes (Bettman, Luce, & Payne, 1998), and also need to make trade-offs between both positive benefits such as animal welfare and (additional) price (Lagerkvist & Hess, 2011; Verbeke, 2009). However, up to now there are only few studies about the question how consumers deal with trade-offs between different production related attributes, for example between production attributes related to the environment (e.g., low carbon footprint) and animal welfare aspects.

Consumer attitude towards animal welfare differs between different parts of the world and even across the EU (Nocella et al., 2010). In general, for the majority of EU citizens it is important to protect the welfare of farmed animals (European Commission, 2016). However, especially consumers in northern EU member countries seem to be more concerned with animal welfare problems than southern citizens or those of new member states (Nocella et al., 2010). German citizens for example rate animal welfare aspects very high; 61% of citizens suggested that it is important to protect farm animals' welfare. In contrast, only 34% of Polish citizens agree with this statement (European Commission, 2016). With a higher-than-average per capita pork consumption in the EU, Germany (51.81 kg/capita/year in 2013 and 52.4 in 2015) and Poland (46.19 kg/capita/year in 2013 and 52.3 in 2015) are both "heavy users" (FAOSTATS, 2017; Danish Agriculture and Food Council, 2016), but the countries differ in their perception and evaluation of animal welfare (European Commission, 2016).

Studies such as the Eurobarometer of the European Commission measure attitudes and opinions and have therefore limited significance concerning real buying behavior (Napolitano, Girolami, et al., 2010; Verbeke, 2009). Furthermore, such studies often draw conclusions based on averages of a sample without taking into account different consumer segments. Thus, these results have to be interpreted carefully (Vanhonacker & Verbeke, 2014). Furthermore, the price premium that consumers are willing to pay is often over-estimated due to hypothetical bias and social desirability effects in answering (Dransfield et al., 2005; Napolitano, Braghieri, et al., 2010). In contrast to the large number of studies regarding WTP for animal welfare or WTP for sustainability attributes (Verain et al., 2012), only few studies have been conducted segmenting consumers based on their preferences for a broader range of production-related attributes (animal welfare, environmental impact, health and safety) and for the more traditional product characteristics (e.g. color, fat content, country of origin, price) (for examples, see Bernués, Olaizola, & Corcoran, 2003; Vanhonacker, Verbeke, Van Poucke, & Tuyttens, 2007).

Trade-offs between different favored attributes can be analyzed using choice experiments (Tonsor et al., 2009). Choice experiments are still hypothetical due to the fact that respondents do not have to exchange real money (Lusk, Roosen, & Fox, 2003). However, they simulate real-life purchasing situations by forcing consumers to make trade-offs between different attributes and therefore allow an analysis of how consumers prioritize their requirements (Tonsor et al., 2009). Against this background, the research objective of this study is first to analyze which production attributes related to environment, health and animal welfare are ranked highest by consumers when making choices about purchases of pork in Germany and Poland. Second, it is investigated how those production attributes that are regarded as important by consumers are traded off against conventional product attributes (fat content, color, origin) and price in a choice experiment. The results are helpful to all stakeholders in the supply chain in designing production processes that give a competitive advantage, in developing marketing strategies based on such production attributes, and in developing

Table 1
Socio-demographic characteristics of both samples.

	Germany ($n = 1007$)	Poland ($n = 998$)
Gender (%)		
Male	52	52
Female	48	48
Age (mean)	51.8	48.9
Age groups (%)		
25–35	14.7	22.7
36–45	17.9	20.4
46–55	21.8	17.9
56–65	33.1	27.2
66 +	12.5	11.7
Education (%)		
ISCDE 1–3	62.8	45.5
ISCDE 4–5	37.2	54.5
# of persons in household (%)		
One	26.9	10.4
Two	44.7	34.3
Three or more	28.4	55.4

appropriate market communication tools.

2. Material and methods

2.1. Data collection and sample characteristics

A cross-national web-based survey was conducted in Germany and Poland in 2015. The population was people eating pork and who have main or shared responsibility for shopping in their household. Respondents were members of online panels of a major market research agency. Sampling was conducted with due concern for demographic variation.

A sample of 1007 pork eaters in Germany and 988 in Poland was obtained (Table 1). The shares of female and male respondents are similar in both studies. The mean age of German consumers was 52 years and for Polish consumers it was 49 years.

The questionnaire was divided into four parts. First respondents should select those two out of ten production characteristics that are most important for them when buying pork (see Table 2). Based on an extended literature research and in consultation with a major pork producer in Poland, these ten aspects were identified as potentially important for consumers and as achievable in pork production either already now or within a time span of a few years. There were four animal welfare attributes: no fixation of animals, castration with anesthesia, availability of straw, and transportation under 4 h. There were four attributes related to health and safety: GMO-free feed, pigs are free of microbial contaminations, complete traceability, and lower use of antibiotics. Finally, there were two environmental aspects: production with zero carbon footprint, manure used for fertilization.

Second, participants had to answer some filler questions unrelated to the main purpose of the survey to avoid priming effects of asking about production characteristics that could result in a bias in the following choice experiment. Third, a choice experiment was conducted. Respondents had to choose between three neck cutlets, differing in visual fat content (high/low), visual color (dark/light), country of origin (domestic, imported from Poland/Germany, produced in EU), price per kilo (in Germany/Euros: 6.00 €, 6.95 € 7.90 €; in Poland/Zloty:16.95 zt, 19.05 zt, 21.15 zt) and the two most important production parameters that the respondent had selected in the first part of the questionnaire (present/not present). Fat content and color were varied in pictures of the product, whereas the other information was presented verbally. The prices used were based on market prices for this type of cut in the two countries plus a premium corresponding to the premium typically achieved for pork products with specific (mostly animal welfare related) production characteristics,

Each participant evaluated twelve choice sets, choosing among the

Table 2
Frequency of selection of production-related attributes as important when shopping for pork.

Production attributes	% chosen in German sample	% chosen in Polish sample
The sow can go loose instead of being fixed for most of their life.	41.5	14.4
Castration of piglets is done using pain killers and local anesthesia.	11.5	3.3
The use of antibiotics is considerably lower than on average German/Polish farms.	25.5	24.9
The feed used for pigs is 100% GMO free.	28.7	43.8
The pigs have access to straw.	10.4	8.8
The pigs are guaranteed free of microbial contaminations like salmonella.	26.4	49.4
The transportation time of pigs from stable to slaughter is no longer than 4 h.	16.9	5.7
The production occurs with a carbon footprint of 0.	3.0	1.1
Manure is used for fertilization and as source of energy.	5.6	7.3
All meat is completely traceable back to the animal.	30.5	41.3

Respondents had to choose those two out of the ten attributes that are most important to them when buying pork; German study: $n = 1007$; Polish study: $n = 998$

three options. Twelve choice sets were regarded as the maximum number of choice sets that respondents can address without too much respondent fatigue. Within this constraint, the best set of choice sets was derived with the SAS Optex procedure based on the D efficiency criterion. One of the three options had to be chosen, i.e., there was no no-choice option.

The last part of the questionnaire contained attitudinal constructs, questions concerning pork buying habits, meat consumption, and sociodemographic questions on gender, age, income, education, number of children and marital status. Interest in healthy eating was measured by eight items from the General Health Interest scale (Roininen, Lähteenmäki, & Tuorila, 1999, Cronbach's alpha 0.66 in Germany, 0.64 in Poland), with higher values indicating higher health consciousness. Price consciousness was measured by five items from Lichtenstein, Ridgway and Netemeyer (1993, Cronbach's alpha 0.78 in Germany, 0.68 in Poland), with higher values indicating more price consciousness. Environmental consciousness was measured by five items from the New Environmental Paradigm scale (Dunlap, Van Liere, Mertig, & Jones, 2000, Cronbach's alpha 0.75 in Germany, 0.49 in Poland, the latter was due to different loadings of positively and negatively framed items), with higher values indicating more environmental consciousness. Attitude to animal welfare was measured using 15 items from Boogaard et al. (2006), which form four dimensions: 1) Human–Animal Hierarchy (HAH, Cronbach's alpha 0.82 in Germany, 0.77 in Poland), with higher values indicating that human is regarded as more important than animal life, 2) Use of Animals for Human Consumption (HC, Cronbach's alpha 0.74 in Germany, 0.77 in Poland), with higher values indicating higher approval of using animals for human consumption, 3) Life Quality of Farm Animals (LQ, Cronbach's alpha 0.83 in Germany, 0.83 in Poland), with higher values indicating a more positive evaluation of the quality of life of farm animals, and 4) Farmers' Image (FI, Cronbach's alpha 0.82 in Germany, 0.72 in Poland), with higher values indicating a more critical attitude to how farmers treat their animals. All these items were answered using a 7-point Likert scale "strongly disagree" to "strongly agree". The questionnaire was first designed in English and then translated to German and Polish by bi-lingual researchers.

2.2. Choice experiment and latent class modeling

The choice data were analyzed by latent class analysis estimated in LatentGold (Vermunt & Magidson, 2005). LatentGold estimates a conditional multinomial logit model, where the probability of choosing an alternative is predicted based on its attributes conditional on the class to which the decision-maker belongs. The effect of attribute levels on choice probability are expressed in part worth utilities that are effect-coded, i.e., part worth utilities for the levels of any particular attribute are scaled to sum to zero. The relative importance of any attribute is calculated by computing the ratio of the range of part worth utilities of that attribute to the sum of all such ranges across attributes. See

Vermunt and Magidson for details and Baba, Kallas, Costa-Font, Gil and Realini (2016) for a similar application with explanations.

Reliability of attitude scales was checked by computing Cronbach's alpha. The segments obtained by the latent class analysis were then profiled using the attitudinal and demographic variables using ANOVAs for the attitudinal variables and cross-tabulations with χ^2 tests for the demographic variables. All analysis except the latent class analysis was done in SPSS 24.

3. Results

3.1. Most important production aspects

First respondents should choose those two out of ten attributes concerning pig production that are most important to them when buying pork. Table 2 shows how many respondents in the German and the Polish samples selected the different attributes. For the German respondents the animal welfare aspect *free mobility for the sow* was the most important production attribute (chosen by 41.5%). Other frequently selected attributes were those related to food safety and health, namely *traceability* (30.5%), *GMO-free feed* (28.4%), *no microbial contamination* (26.4%), and *less use of antibiotics* (25.5%). The least often selected attribute for the German respondents was a *production with a zero carbon footprint* (3.0%).

For the Polish respondents, the most frequently selected attributes were the food safety attributes *no microbial contamination* (49.4%), *GMO-free feed* (43.8%) and *traceability* (41.3%). Animal welfare attributes were less frequently selected. Furthermore, very few respondents selected a production with a *carbon footprint of zero* (1.1%).

3.2. Results of choice experiment

A logit model was estimated to show how the various attributes in the choice task impact respondents' choices. Table 3 shows the parameters for the impact of the attributes included in the choice experiment for the two samples. This included, for each respondent, those two production attributes that s/he had selected in the preceding task, as documented in Table 2. For both German and Polish respondents, country of origin turned out to be the most important attribute in explaining their choices (relative importance 35% for the German and 28% for the Polish sample). For the German respondents the most important production attribute (in most cases free mobility for the sow) was second in importance (18%), followed by fat content (15%), price (12%) and color of meat (10%). In comparison, the most important attributes for the Polish respondents after origin were the attributes fat content (21%), price (18%), and color of meat (17%). In both countries, pork with light color, a low fat content and from domestic origin was preferred. Willingness to pay for the first selected production attribute (computed as $u_{process}/ - u_{price}$) was 1.52 €/kg in Germany and 0.54 zt/kg in Poland. Note that this is the WTP for the most important production

Table 3
Results of choice experiment.

	Whole sample			Segment 1: Production interested	Segment 2: Fat and color	Segment 3: Price conscious	Segment 4: Origin	Overall for segment solution				
Germany												
Segment size	100%			**39%**	**25%**	**21%**	**15%**					
R^2	0.20			0.32	0.53	0.17	0.94	0.46				
R^2 (0)	0.21			0.33	0.54	0.18	0.95	0.47				
Attributes		Wald	p-value	Class1	Class2	Class3	Class4	Wald		p-value	Wald (=)	p-value
Color of meat	**10%**			17%	22%	21%	7%					
Light	0.20	268.97	0.000	0.03	0.68	0.33	2.41	329.61		0.000	178.13	0.000
Dark	− 0.20			− 0.03	− 0.68	− 0.33	− 2.41					
Fat content	**15%**			10%	42%	17%	6%					
Low	0.30	768.77	0.000	0.22	1.34	− 0.28	2.34	765.44		0.000	734.46	0.000
High	− 0.30			− 0.22	− 1.34	0.28	− 2.34					
Production parameter 1	**18%**			31%	9%	2%	15%					
Not present	− 0.35	971.87	0.000	− 0.73	− 0.27	0.02	− 5.45	544.60		0.000	374.54	0.000
Present	0.35			0.73	0.27	− 0.02	5.45					
Production parameter 2	**9%**			18%	4%	11%	5%					
Not present	− 0.17	271.91	0.000	− 0.41	− 0.12	− 0.17	1.88	418.06		0.000	115.42	0.000
Present	0.17			0.41	0.12	0.17	− 1.88					
Price	**12%**			5%	3%	37%	23%					
	− 0.23	308.40	0.000	− 0.12	− 0.09	− 0.60	− 8.24	322.52		0.000	177.34	0.000
Origin	**35%**			35%	21%	12%	44%					
Poland	− 0.63			− 0.74	− 0.66	− 0.13	− 16.86					
Germany	0.75	2976.10	0.000	0.88	0.68	0.25	14.75	1053.87		0.000	290.48	0.000
EU	− 0.11			− 0.14	− 0.02	− 0.12	2.11					
Intercept				0.41	0.06	− 0.17	− 0.30	53.78		0.000		

	Whole sample			Segment 1: Fat and color	Segment 2: Production interested	Segment 3: Origin	Segment 4: Price conscious	Overall for segment solution				
Poland												
Segment size	100%			**36%**	**25%**	**20%**	**17%**					
R^2	0.22			0.45	0.23	0.95	0.27	0.50				
R^2 (0)	0.23			0.48	0.24	0.95	0.29	0.50				
Attributes	Class1	Wald	p-value	Class1	Class2	Class3	Class4	Wald		p-value	Wald (=)	p-value
Color of meat	**17%**			27%	1%	14%	31%					
Light	0.3	760.42	0.000	0.86	− 0.02	2.81	0.83	832.00		0.000	555.49	0.000
Dark	− 0.30			− 0.86	0.02	− 2.81	− 0.83					
Fat content	**21%**			39%	9%	16%	2%					
Low	0.44	1485.75	0.000	1.23	0.18	3.19	0.07	798.56		0.000	684.08	0.000
High	− 0.44			− 1.23	− 0.18	− 3.19	− 0.07					
Production parameter 1	10%			8%	26%	0%	8%					
Not present	− 0.20	324.60	0.000	− 0.26	− 0.51	− 0.01	0.23	483.78		0.000	270.54	0.000
Present	0.20			0.26	0.51	0.01	− 0.23					
Production parameter 2	**5%**			3%	16%	5%	4%					
Not present	− 0.10	90.96	0.000	− 0.10	− 0.32	0.97	− 0.12	203.54		0.000	70.91	0.000
Present	0.10			0.10	0.32	− 0.97	0.12					
Price	**18%**			8%	15%	22%	39%					
	− 0.37	693.75	0.000	− 0.27	− 0.30	− 4.26	− 1.02	525.79		0.000	176.83	0.000
Origin	**28%**			13%	30%	40%	12%					
Poland	0.72	2706.65	0.000	0.55	0.70	8.13	0.27	833.50		0.000	124.47	0.000
Germany	− 0.44			− 0.27	− 0.49	− 7.26	0.09					
EU	− 0.27			− 0.27	− 0.20	− 0.86	− 0.37					
Intercept				0.41	0.06	− 0.17	− 0.30	53.78		0.000		

attribute selected by the respondent, not for any particular production attribute.

3.3. Segmentation analysis

A latent class analysis was conducted to classify respondents according their evaluation of product attributes when buying pork. A four-cluster solution was chosen as the best compromise between interpretability and the evaluation of the drop in the Bayesian information criterion (BIC) and the Akaike information criterion (AIC) that are commonly used to evaluate model fit in latent class analysis (Nylund, Asparouhov, & Muthén, 2007). The results of the four-cluster solution and the parameters for each segment are shown in Table 3. The interpretation of the four segments is similar in Germany and Poland.

The first and biggest German segment with 39% of the German sample is called the *production-interested* (Table 3). A similar segment could also be found in the Polish sample and represents 25% of the Polish sample. Respondents in this segment attached most importance to the (for them) most important production characteristic, which had a relative importance of 31% (German sample) and 26% (Polish sample)

Table 4
Differences between segments: attitudinal variables.

	General health interest	Price consciousness	Mental consciousness	Farmers' image	Human-animal hierarchy	Life quality of farm animals	Use of animals for human consumption
Germany	(0.00)	(0.12)	(0.00)	(0.00)	(0.01)	(0.00)	(0.09)
Production interested	4.67[b,c]	4.38	5.47[c]	4.84[a]	4.10[a]	3.71[a]	4.99
Fat and color	4.46[b]	4.29	4.88[a]	4.41[b]	4.39[a,b]	4.14[b]	4.99
Price conscious	4.16[a]	4.50	4.83[a]	4.51[b]	4.60[b]	4.25[b]	5.24
Origin	4.74[c]	4.22	5.17[b]	4.39[b]	4.26[a,b]	4.22[b]	4.99
Poland	(0.00)	(0.00)	(0.45)	(0.04)	(0.55)	(0.00)	(0.53)
Fat and color	4.63[a]	4.22[a]	4.62	4.61[a,b]	4.78	3.81[a]	5.25
Production interested	4.68[a]	4.24[a]	4.54	4.77[b]	4.68	3.73[a]	5.13
Price conscious	4.69[a]	4.12[a]	4.52	4.57[a,b]	4.82	4.15[b]	5.13
Origin	4.23[b]	4.58[b]	4.52	4.48[a]	4.91	3.82[a]	5.22

Numbers without parentheses are scale means on a scale from 1 to 7, numbers in parentheses are p-values from ANOVA F-test. Different superscripts indicate statistically different values between segments, $p = 0.05$, Scheffé test; German study: $n = 1007$; Polish study: $n = 998$

in their choices. The *production-interested* Germans expressed a significantly higher environmental consciousness and were more critical towards farmers as shown in Table 4. Furthermore, this segment scores higher on health and animal welfare consciousness. The *production-interested* Polish were also more critical towards farmers in comparison to other segments; however in Poland this segment showed no further significant differences to the other segments.

The biggest Polish segment was called *fat and color* and consists of 36% of the Polish sample. In the German sample 25% of the participants belong to a similar segment. Respondents in this segment attach high importance to the fat content and color attributes. The second most important attribute for those participants was the country of origin. Production attributes seem to be not really important for those respondents.

The segment *price conscious* was found in both the German and the Polish sample and consists of 21% German and 17% Polish respondents. In addition to price, respondents in this segment are interested in sensory attributes such as color (relative importance 21% in the German and 31% in the Polish sample) or fat content (relative importance 17% in the German but only 2% in the Polish sample). German consumers in this segment have the lowest general health interest and environmental consciousness in comparison to other German segments. Furthermore, they scored human-animal hierarchy as high and thus most respondents in this segment are convinced that the use of animals for human consumption is justified. Polish respondents in this segment rated life quality of farm animals lower in comparison to other segments and were more price-oriented (Table 4).

The fourth and last segment (*origin*) was in the German sample with 15% of the respondents the smallest one. The corresponding segment in the Polish sample was with 20% of the respondents bigger in comparison to the German one. The respondents in both samples belonging to the *origin* sample had price as second most important criterion. According to Table 4, Polish respondents in this segment have a lower general health interest and a higher price consciousness in comparison to other segments. In contrast the German segment has the highest general health interest compared to the other segments.

Willingness to pay for the first selected production attribute was not surprisingly highest in the production interested segment (6.08 € in Germany, 1.70 zt in Poland) and considerably lower for the other segments (fat and color: 2.31 €/0.96 zt, origin: 0.66 €/0 zt, price conscious: 0.03 €/0.23 zt).

With respect to socio-demographic features, cross-tabulations of age categories with segment membership indicated a significant relationship between age and segment ($p = 0.02$ in Germany, $p = 0.02$ in Poland, χ^2 test). In both countries younger people were more likely to be a member of the *production-interested* segment. There was no significant relationship between level of education and segment

membership in Germany, but in Poland respondents with a higher level of education were more likely to be a member of the *production interested* segment ($p = 0.00$, χ^2 test). In Germany, male respondents were more likely to be in the *price-conscious* segment ($p = 0.00$, χ^2 test), whereas there was no such relationship in Poland.

4. Discussion and conclusion

4.1. Importance of production aspects related to animal welfare, health and the environment

The first objective of the study was to identify whether attributes of the pig production process related to ecological footprint, animal welfare considerations and health-related aspects have an impact on German and Polish consumers' food choice when buying pork, as compared to traditional product attributes (such as fat content, color, origin, and price). This was investigated by means of a choice experiment.

The results of this study among a German and a Polish sample show that, in general, the German and Polish respondents' most desired process characteristics were those giving individual benefits rather than societal or animal benefits (less antibiotics, GMO-free feed, complete traceability, no microbial contamination), which is in line with other studies (Liljenstolpe, 2008; Verain, Sijtsema, & Antonides, 2016). In Germany, the process characteristic selected as most important by respondents (in most cases free mobility for the sow) was more important in explaining respondents' choices than in the Polish sample. While origin of the meat was the attribute most important to consumers in both samples, in Poland the production parameter chosen as the most important (in most cases no microbial contamination) was only fifth priority, after fat content, price and color. Therefore, animal welfare attributes are evaluated as relatively unimportant by most Polish respondents, which is also in line with the study of the European Commission (2016).

Overall, a production with a carbon footprint of zero was regarded as least important by respondents in both countries. Van Loo et al. (2014) also found that carbon footprint labels are less appealing to consumers, which can be due to the fact that many people are confused about the meaning of carbon footprint or find it difficult to relate it to animal production.

An additional finding in the study was that willingness to pay a premium for pork with desired production attributes was higher in Germany than in Poland. This is in line with a study by Nocella et al. (2010) finding that EU-countries such as Germany, France, and Great Britain have a higher willingness to pay for animal welfare attributes than Spanish or Italian consumers. Lagerkvist and Hess (2011) also found that German and French consumers have a higher willingness to

pay for farm animal welfare attributes in comparison to Denmark. Both studies show that the willingness to pay tends to be influenced by national policy, the awareness of food scandals and cross-cultural differences.

In general, the attributes origin, fat content, and color seem to be most important to German and Polish consumers and have the highest impact on their pork choice, suggesting that they provide most benefit for consumers. However, consumers especially in industrialized countries stated in many different studies that they are concerned about farm animal welfare, especially in pig production (Bergstra, Hogeveen, & Stassen, 2014; Clark, Stewart, Panzone, Kyriazakis, & Frewer, 2016; Spooner, Schuppli, & Fraser, 2014; Vanhonacker et al., 2009). Grunert, Hieke, and Wills (2014) asked consumers from the UK, France, Germany, Spain, Sweden and Poland about their level of concern with sustainability issues such as Fair Trade, Rainforest Alliance, carbon footprint, and animal welfare. They found that German and Spanish respondents had the highest and Swedish and Polish consumers the lowest level of concern regarding sustainability topics. However, they also found that the concern of consumers does not necessarily translate into buying behavior, which can be due to the different trade-offs consumers have to make when shopping, as also demonstrated in our study. Furthermore, a lack of transparency, credibility, and availability of information about ethical characteristics of production can also diminish the role of ethical product attributes in making choices (Grunert et al., 2014).

4.2. How do the segments differ?

Furthermore, it was the objective of this study to identify and analyze different consumer segments. The present study identified four consumer segments in both the Polish and the German sample: *production interested*, *fat and color*, *price conscious* and *origin*. These two sets of four segments were identified by separate analyses of the German and the Polish data. It is therefore noteworthy that the basic structure and interpretation of the two segment solutions are the same, although the statistical details of course differ.

Both in Germany and in Poland there was a segment with interest in production-related attributes. However, in Germany this segment was with 39% of the entire sample bigger than in Poland with 26% of the respondents. Thus, there were considerable national differences, showing that the *production interested* segment is not homogenous. This is also evidenced in Table 4, which indicates that also those segments that are comparable across the two countries in the weight given to different choice attributes do nevertheless differ in their attitudinal profiling. The German *production interested* respondents have higher environmental consciousness than the other German segments, but a similar difference is not found in the Polish sample. In Germany the *production interested* segment showed a higher general health interest and more concern for the life quality of farm animals. The *production interested* respondents were also more critical towards farmers. Thus, consumers who are interested in production attributes seem to be more critical and have less acceptance of what they perceive as the famers´ view (Table 4). In the Polish *production interested* segment, the attitudinal profiling was much less pronounced, although also here there was a tendency for them to be more critical towards farmers.

In contrast, respondents in the segment *price conscious* (21% of German and 17% of Polish sample) showed less environmental consciousness, but again only in the German sample. Verain et al. (2012) found a cluster which is called the "non-green segment" and consists of consumers which are price-oriented, express lower concern and trust the industry, which is comparable to the results for the German sample in this study. In the German sample more male respondents were found in the *price conscious* segments. This result is in line with Papanagiotou, Tzimitra-Kalogianni, and Melfou (2013), who also found out that males often prefer cheap pork and are oriented towards sensory attributes. Otherwise no significant differences in demographic criteria could be identified.

The *fat and color* segment consists of people who tend to prefer visible parameters when buying pork. For both Polish and German respondents in this segment fat content was most important (42% relative importance for German and 39% for Polish respondents) followed by color (22% in Germany and 27% in Poland). The third most important attribute when buying pork in this segment was origin (21% in Germany and 13% in Poland).

With regard to the *origin* segments a difference between the German and Polish segments emerged: the German *origin* segment (15%) expressed high interest in heath, was not really price-conscious and had relatively high environmental consciousness. The Polish *fat and color* (36%) segment showed similar tendencies. In contrast, the Polish *origin* segment (17%) were not very interested in health, but was price-conscious and more comparable with the German segment *price conscious* (21% of the German sample). Overall both German and Polish *origin* segments set price as second important criterion after origin (23% importance in Germany and 22% in Poland).

The four segments identified show the different ways in which consumers trade attributes off against each other when buying pork and therefore underline the importance of thinking in terms of different consumer segments when devising market offerings on the pork market (Verain et al., 2016). Clearly the market for pork products is differentiated in each country. Both countries have segments that are best served by a low-price basis product, and other segments that response positively to low fat, the right color, and/or domestic origin. We do in both countries also find sizable segments that attach value to production attributes, although this segment is larger in Germany than in Poland and the willingness to pay for the most desired production attribute by these consumers is also considerably higher in Germany than in Poland. However, it must be remembered that the choice alternatives in this study incorporated those two production attributes that the respondent him−/herself had selected as the most important, and of course there are differences here as well. The market may therefore support several niche products positioned in terms of different production attributes. In positioning such products, it seems that individual benefits in terms of health and safety have still more appeal to consumers than societal benefits in terms of animal welfare and/or environmental impact.

4.3. Limitations

The major limitation of the current study is the use of a hypothetical choice experiment that does not involve physical products and real money. The study can be used as the basis for designing an auction experiment that would overcome this limitation. Our study is also limited by the choice of attributes entering the choice experiments. There is good evidence that the non-production related attributes used are those most important to consumers, and the production attributes used have been selected in terms of potential relevance and actual feasibility. However, consumers are confronted with other types of information when shopping, including various quality seals and animal welfare certification schemes, which we have not investigated. Finally, we should also note that providing information about production characteristics always involves a credibility issue that must be addressed whenever such attributes are used in the marketing of pork.

4.4. Implications for the pork industry

The results suggest that production characteristics can indeed be used to position pork products on the German and Polish markets. However, it is clear that careful segmentation is necessary, that production characteristics do not appeal to all consumers, and that different bundles of production characteristics apply to different consumers. There was interest in the animal-welfare related attribute about mobility in the German sample, but apart from that the most attractive

production characteristics center around health and safety, i.e., to individually (as opposed to societally) relevant benefits. In the current situation, the major distinction on the pork market is between conventional and organic production. Organic production is mainly defined in terms of environmental and animal welfare benefits, and the present data therefore suggest that there can be room in the market for a different positioning based on production characteristics related to health and safety, like low use of antibiotics, guaranteed absence of microbial contamination, and guaranteed GMO-free feed. Such a positioning could be developed in close contact with the retail chains.

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